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DISSERTATION
ON *1744*
BOTANY.

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OF EDINBURGH.

TRANSLATED FROM THE LATIN BY A
PHYSICIAN.

LONDON:
PRINTED FOR BENJ. DOD, AT THE BIBLE
AND KEY IN AVE-MARY-LANE.
MDCCLIV.

11

DISSERTATION

ON

BOTANY

Jos. Banks

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[iii]

T H E
TRANSLATOR'S
P R E F A C E.

AFTER the restoration of the *Greek*,
Roman and *Arabian* learning, in
the latter end of the fourteenth, or
beginning of the fifteenth century, *Botany*,
with most other Arts and Sciences, from
the discoveries and improvements made
by the laborious researches of curious and
ingenious men, put on a new face; and,
though still very imperfect, it now flourishes
and is adorned with the most conspicuous
excellencies. The sum of the antient bo-
tanical treasures might have been retained
by a strong memory; but, since the times

of barbarism, they have been enriched with a vast number of new plants by many botanists, some of the latest of whom are *Sloane, Sherard, Plukenet, Chomel, Plumier, Petiver, Dale, Morison, Tournefort, Breynius, Herman*, both the *Commelines*, *Rheede, Rumphius, Ray, Dillenius, Ruppins, Boerhaave, Scheucher, Vaillant, Magnol, Montius, Pontedera, Michel, Houston, Linnaus, &c.*; their general structure has been unravelled, and the uses of their parts pointed out by the two great vegetable anatomists, *Malpighius* and *Grew*; various ways of methodising them, which from their multitude became very necessary, have been contrived, the manner of cultivating a considerable share of them described, and the virtues of several found out: yet, doubtless, an indefinite number of vegetables remain undiscovered in all parts of the world.

BOTANY, therefore, appears to be an Art of prodigious extent: And if its antiquity, the dignity of the persons who have employed themselves in it, and the great usefulness, variety and delight it affords, render it valuable, noble and honourable,

P R E F A C E

honourable, it claims all these advantages in the highest degree. Its rise may be deduced from the creation, its progress and fates traced through succeeding ages, and its history brought down to this day. *Adam* is reckoned to have been the first; and a most intelligent Botanist; Kings, Princes, Heroes, Generals of armies, Philosophers, Divines, Physicians, Poets, &c. have studied this branch of natural knowledge; many of the most necessary and comfortable human enjoyments are derived from its instruments; life is sustained, and health is preserved by some of them; and diseases are cured by others: Moreover, the easy culture of plants is extremely wholesome and amusing, and the examination of the manifold states and beautiful changes of vegetables, whose variety is almost infinite, growing in gardens, fields, hills, valleys, woods, forests, marshes, lakes, rivers, the sea, on rocks, on one another, &c. has a powerful tendency to make men patient of toil and labour, solid and serious; to infuse the most desirable serenity and composure into the mind; and to fit it for a more relishing and successful application

plication to other business; while it yields such an high satisfaction and pleasure as can be felt by those that are conversant therein, but cannot be justly painted in words, though embellished with all the flowers of rhetoric.

It is sufficient to recommend to the public the following Discourse, that its author is the celebrated Doctor ALSTON, who is well known to have been many years one of the Professors of Medicine in the University of *Edinburgh*, teaching in the winter, that branch of the science called the *Materia Medica*, and in the summer, *Botany*; the cultivation of both which parts of medical knowledge has been the principal study of his life. His great natural abilities, learning, universal knowledge, sagacity, accuracy, candour, caution, solid judgment, indefatigable industry, inventive investigation, ardent love and steady pursuit of truth, and sacred regard for the public emolument and utility, joined to that tempering sweetness of disposition, which is very predominant in him, have enabled him by a long course of experience in practice, experiments

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periments and observations on natural bodies, much speculation, reading, deliberation and reasoning, to make useful improvements and discoveries, and detect egregious errors in the two above-mentioned provinces of the medicinal art, than which parts of medicine none are more fundamentally beneficial and entertaining, and yet none have been hitherto less studied and less improved. His most elegant Dissertation on *Opium*, in the *Edinburgh Medical Essays*, Vol. V. Part I. that on *Quick-Lime* and *Lime-Water*, his *Index Medicamentorum Triplex*, and the subsequent treatise taken from his *Tirocinium Botanicum Edinburgense*, are confessedly substantial proofs of his shining talents and merit, and do him so great honour, that the learned vehemently desire and impatiently expect to see published by him a larger work, of which some of these less performances may perhaps be looked on as detached parts. I hope the Professor will pardon me for attempting to delineate a rude portrait of his illustrious endowments; which, though it is neither equal to the original, nor reconcilable

conciliable to his delicate modesty, may shew my personal esteem of him, and that gratitude to him, for the benefit I have reaped from his already published tracts, which is a debt of common justice.

THE Doctor prefatorily observes, that in the botanical Dissertation, the main arguments of the general Lectures, which he gives previously to the Demonstration of the plants in the Physick-Garden, are briefly handled; that students may therefrom acquire a just and worthy idea of Botany. He also recites the following quotation: "Every student of medicine, at the beginning of his application to that science, ought always to exercise himself first in this study; since it is the most natural to the human genius, in reality very easy, and entirely agreeable to a mind free from weightier care. It is, indeed, a publickly conceived and strong vulgar notion, that it is sufficient as it were for a Physician to learn to know faithfully a few plants, possessed of healing virtues, and foolish to pursue glory in surveying the rest, as it is useless. Yet this opinion, I think, is far

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“ far from being true : nay, on the con-
 “ trary, I believe that notwithstanding
 “ students of physic ought indeed to be
 “ chiefly acquainted with the plants dig-
 “ nified for their approved uses ; at the
 “ same time, as they have opportunity,
 “ they should, though more slightly, con-
 “ template all others.” *

I shall only add, that in this transla-
 tion, an explanation of some of the words
 and terms, whose meanings are either ob-
 scure, or uncommon, is here and there
 inserted.

* *H. Boerhaave Index alter Planta-
 rum, quæ in Horto Academico Lugduno-
 Batavo aluntur. Lugd. Bat. 1720. in 4to.
 Vid. præf. p. 10.*

THE FIVE C'S

1. The first being that a copy of the con-
tract, I believe, that notwithstanding
the absence of the copy ought to be
sufficiently adequate. I will not dispute this
point for they approved of it; so the
second thing, as they have approved it,
they should not withdraw it, con-
sidering the object.
3. I will only add, that in this case
you, an explanation of some of the words
and terms, what meanings are either of
terms or uncertainty, is here and there
inserted.

* In Boeckmann Index after Plinius
p. 10, que in libro Academicis Lysimachio
p. 10, quod in libro Academicis Lysimachio
p. 10, quod in libro Academicis Lysimachio

A
DISSERTATION
ON
BOTANY.

I. **T**HE Professors of this art have long enough complained, that the knowledge of plants is neglected by most students of medicine, despised by many, and as it were hated by some physicians. And it is indeed to be regretted, that even at this day, by reason of the immensely multiplied names of plants, uncertain terms, theories, methods, and idle philological controversies about them, it does, in some measure, seem to be unworthy of the regard of men, who excel in learning or genius.

Yet, since the Doctrine of Herbs, or Botany, is that part of natural knowledge, which, besides the names as well as methodical distribution of vegetables,

tables, treats of their external and internal structure, their vegetation, nutrition, fructification, use, virtues, culture, and the like; the contemplation of these things may either lead to the veneration and love of the great Creator, or redound to the advantage of mankind.

2. Neither my abilities, nor the nature of my design, permit me to discourse on the parts of this very extensive science. I propose, however, to make some short remarks, no less useful than entertaining, concerning the heads of this subject, lest Botany should appear to be quite tedious and barren to learners, as consisting solely in an acquaintance with names and technical words.

“ The Subject, or natural History of Herbs, or
 “ Botany as it is commonly called, is divided in-
 “ to two parts; the first of which consists in the
 “ right knowledge of plants, and the second in
 “ applying them to their most beneficial uses.
 “ Nothing more seems requisite to know plants
 “ very well, than to call them readily by the
 “ names which are properly imposed upon them:
 “ for, in this art those ought indeed to be chosen
 “ which have some connexion with an idea of the
 “ structure of the parts, from which the distin-
 “ guishing mark, or characteristic of plants a-
 “ rises.” *

“ Botany is nothing else but a method, by
 “ whose aid plants are known the most advan-
 “ tageously,

* *Josephi Pitton Tournesfort Institutiones rei
 herbariæ. Parisiis 1700. 3 Voll. in 4to. Item
 Lugduni 1719. Vid. pag. 1.*

“tageously, and with the least trouble, and remembered.” *

“Botany is the science of vegetables, or the knowledge of those things that are transacted by plants and in plants.” †

§. I.

3. “On the whole, says *Theophrastus*, a plant is a various and manifold thing; and it is universally difficult to tell what it is. There is no absolutely distinct mark, which may be reckoned common to and agreeing with all plants, as a mouth and stomach are proper to animals. For, neither a root, nor stalk, nor branch, nor bud, nor leaf, nor flower, nor fruit, seems to belong to every plant.” ‡ Hence it is, that scarce an accurate definition agreeing to all plants and those alone is to be met with in authors.

4. “A Plant, as *Fungius* defines it, is a living but not a feeling body, fixed to a certain place or certain seat, which can be nourished, grow, and

* *Historia Plantarum, quæ in Horto Lugduno-Batavo crescunt; desumpta ex ore Cl. Hermannii Boerhaave. Romæ 1727. in 8vo. Vid. p. 16.* This work is evidently unworthy of the most celebrated Professor.

† *Ludwig. aphor. 1. Caroli Linnæi Philosophia Botanica, in qua explicantur Fundamenta Botanica. Stockholmia 1751. in 8vo.*

‡ *Theophrasti Eresii opera omnia. Lugd. Bat. 1613. in folio. Vid. Hist. Pl. l. 1. c. 2.*

“ and lastly propagate itself.” * According to the most famous *Tournefort* †, “ It is an organical body, which is always furnished with roots, perhaps always with seeds, and almost always has leaves, flowers, and stems.” “ All that substance which from the body whereto it adheres or that surrounds it, says *Pontedera*, is explicated with the juice flowing to it into some certain and determinate form, by the influence of the air contained in its tracheæ (or air vessels) seems to appertain to a plant.” ‡ “ Vegetables, as *Ludwig* would have it, are named natural bodies, always endued with the same form, but void of loco-motion.” || And lastly with the illustrious *Boerhaave*, “ A Plant is an hydraulic body, conveying different fluids in different vessels, which adheres by some external part to another body, whence by that part it draws the matter of its nourishment and growth.” |||

These definitions however seem neither to include all vegetables, nor exclude all animals; since some of the latter are constantly fixed to another body, and some of the former float freely on the

* *Joannis Raii Historia Plantarum. 3 Voll. in folio Londini Vol. 1. 1686. 2. 1688. 3. 1704. Vid. pag. 1.*

† *Ist. p. 54.*

‡ *Julii Pontedera Anthologia, sive de floribus natura libri tres; cum Dissertationibus xi. Patavii 1720. in 4to. Vid. Dissert. 1. p. 5.*

|| *L. Phil. Bot. p. 1.*

||| *Element. Chem. Tom. 1. p. 57.*

The surface of water. Nor will the description of the most famous *Linnaeus* supply their defect *, who before he had understood any thing by life, should have explained it otherwise than is done in the *Sponsalia Plantarum* †, and have proved that all animals have sensation:

5. Are therefore the great kingdoms of nature to be confounded? Or are vegetables to be classed with animals? By no means. They agree in many things but not in all. They all grow indeed and are nourished: yet, since animals receive the matter of their nourishment by pores or vessels situated on their internal surface; but vegetables take in theirs by pores or vessels placed on their external surface; this is a sufficiently notorious and essential difference. A vegetable may therefore be described, to be an organical body, which draws the matter of its nourishment and growth by pores or vessels placed on its external surface. And consequently it may be aptly enough called an *inverted animal*.

§. II.

6. A vegetable performs two grand works, as the great *Cesalpinus* speaks ‡, which are as it were

* *Fundamenta Botanica: Amstelodami* 1736. in 8vo. Edit. 4. auctior. *Parisiis* 1744. Vid. §. 3.

† *Joh. Gustavi Wahlbom. Spons. Pl. in Lin. Amen. Acad. Vol. 1. p. 64.*

‡ *Andree Cesalpini de Plantis libri xvi. Florentiæ* 1583. *Ejusdem Appendix. Romæ* 1603. in 4to. Vid. prioris l. 1. c. 13.

were its natural functions, or offices: the first of which is the attraction of aliment, whereby it is nourished and grows; and for the sake whereof it is provided with a root and bud. But the second function, or work, of a vegetable, is the generation of another like itself; and the parts given to it on this account are the fruit, and likewise the flowers, which are subservient to fructification. We shall take a cursory view of the external and internal structure of these parts; and afterwards of their use in vegetation and fructification.

7. The *Root* is the inferior part of a plant, generally concealed in the earth, destined for attracting aliment, composed for most part of a cuticle, bark, wood, and pith; and it is either fibrous, or tuberous, or bulbous.

But according to the most famous *Ray* *, roots may be divided into the *fibrous* and *thicker*. He calls those *fibrous* which consist only of many filaments. The *thicker* or *fleshy* are such as *swell much out in breadth*, or are *extended greatly in length*. The *broad fleshy* roots are either *bulbous* or *tuberous*. The *bulbous* are either *coated*, as the *Onion*, or *scaly*, as the *Lily*. The *tuberous* (*knobby*) or those constituted of continuous flesh, have either a *simple* tuber (*knob*), as *Turneps*, or *several knobs*, as the *Peony*. *Long* roots are either *twiggy* and *creeping*, as the *Liquorice*, or *stalk-like*, as the *Cock's-head vetch* or *Saintfoin*.

8. The *Trunk* is a more remarkable part, by which trees and most herbs are raised up: its lower

* *Hist. Pl. p. 3.*

lower extremity is separated into spreading, or as it were jagged roots, that are fixed in the earth, and all the rest of it is divided and subdivided into branches, on which leaves, flowers, and at last seeds, hang. It has various names bestowed upon it. In trees it is called *caudex* (the tail, or stock, or body, or stump), *stipes* (the stalk, or stem), and *truncus* (the trunk, or boll); but in herbs (also in fruits) *caulis* (the stem, or stalk); and particularly, in the tubular kinds of them, it has obtained the appellation *calamus* (the reed, or cane, or straw); in the leguminous (or all sorts of pulse) *scapus* (the upright pillar-like stalk, or stem); and in all manner of corn, or grain, *culmus* (the stem, or stalk, or straw from the root to the ear)*. It consists of the same parts as the root; and is either single, or branched.

9. The *Leaves*, in whose abundance nature seems to be luxuriant, are principal and remarkable parts, by which trees and herbs are perfected. For, all those things which are collected in the trunk or stem, being reduced as it were into a compend, and resolved by a farther production into extreme and younger parts, are expanded into leaves, so that they seem to be the *appendices* of the elongated and disgregated trunk, serving to concoct the aliment†. A leaf is either *simple* or *compound*. A *simple* is either *plane*, with an intire and equal,

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* Marcelli Malpighii opera omnia, in duos tomos distributa, quorum prior Anatome plantarum est. Lugd. Bat. 1687. in 4to. Vid. p. 19.

† Ibid. p. 53.

or a variously unequal margin; or round. A compound leaf is either *triangular*, or *digitated*, or *winged* *. Concerning Flowers, see below § x.

§. III.

10. That plants consist chiefly of very small tubes and vesicles, with their contained fluids, *Malpighius* long ago first demonstrated. Some of these pipes contain humours, and others only air, which therefore always appear empty: almost the same may be said of the vesicles; yet with this difference, that only the vesicles of the pith, after the first year, never have any juice in them. A brief account of these parts follows, with their use, from that illustrious author.

11. The *ligneous fibres*, which were antiently styled *nerves*, *filaments*, and *pectines* (or *woody veins*), are tubular substances, pervious to entering liquors; whose texture consists of square, or orbicular, hollow bodies, opening into one another. These vessels neither run in a straight nor parallel direction; for, they are generally gathered into a little bundle; and some of them being again bent and separated, they form a net-work †. These fibrous packets are made up of a great many threads; and every observable fibre is constituted of pipes communicating with each other, and pours out a fluid: But in its progress it is bended sideways and united to another packet; it is then stretched directly upwards, and afterwards obliquely, and being

* *Raii Hist. Pl. p. 13.*

† *Malpig. p. 22.*

being interwoven with the nearest little bundle, a net-work is thereby fashioned. The greatest share of the bulk of the wood is made up of these threads, or pipes, running lengthways, which again are composed of orbiculi, or little round concave balls, or bottles, or bladders, opening into one another, disposed also longitudinally *.

12. Among the above-explained fibrous or fistular packets the *spiral pipes* are placed, which are less numerous than the woody fibres, but of a bigger size, so that their open mouths may be seen gaping on the cut extremities of trunks. They have various situations; but the greatest share of them is comprehended under different circles, variously placed about a center, and containing each other. They are not constantly of the same external figure; yet, for most part, they have an oblong and tubular form, and are here and there a little straitened in their diameters, so as to resemble many orbiculi, or little round bottles, communicating with one another: sometimes however, these utriculi, or little bottles, have different angles, and make a continued canal; and sometimes smooth, transparent, and oval little bags, impervious at one end, like those observed in the lungs of insects, are found; likewise, frequently many orders, or rows, of vesicles straitening each other, and contained as it were in the same woody tube, form these spiral pipes.

The described spiral tubes are composed of a thin and pellucid zone, (*resembling a piece of ribbon, or tape*;) or as it were a very narrow lamina

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* Malpig. p. 2.

of a silver colour, which being contorted spirally, and contiguous at the (*somewhat everlapping*) extremities of its edges, constitutes a tube that is a little rough, both internally and externally. A beautiful sight is presented in some plants: while the continuity of a recent and unwithered branch, or stalk, (*as likewise the leaf and root, for example, of the Vine, both the Cornels, the Scabious, Squil, &c.*) is gradually pulled asunder, torn or broken portions of the spiral pipes, or tracheæ, remain. For, these sometimes keep up as it were a peristaltic motion for a considerable time *. If this lamina (*or membrane*) be farther viewed through a microscope, it is seen to consist of particles placed like scales on the skins of fishes; which mechanism is also found in the tracheæ of insects †.

These pipes, which he pleased sometimes to name *spiral* from their composition, but more properly *tracheæ* from their office, are found in all trunks, small stalks, leaves, flowers, and the other parts with which vegetables are completed, and they are continually open. In the ligneous portion they abound more and less plentifully, and obtain such a position, as to be perpetually surrounded and inclosed, as it were in a sheath, by a little bundle of woody fibres; and in the small stalks of some plants, collections of these tracheæ, or air-vessels, are so very artfully associated with the ligneous fibres, as necessarily to be a mystery of nature ‡. In plants and insects nature has so ingeniously framed the spiral lamina, which is fabricated

* *Malpig. p. 3.*

† *Id. p. 26.*

‡ *Id. p. 31.*

bricated of small scales, that it may suffer contraction and dilatation in the violent flexions and curvatures of trees, and from the elastic motion of the confined air. The thus constituted tracheæ of plants, without declining much from a straight course, are dispersed from the roots upwards into the trunk, stalk, and branches; but in the leaves they have a crooked distribution and are wrought into a net-work *. In the bark no tracheæ have been yet discovered; nor, so far as I know, in the seed.

13. The intermediate spaces in the net-work of the fibrous pipes are filled with *utriculi*, or roundish little bags; besides, a whole packet of fibres is here and there encompassed with them, and they have for most part an horizontal direction: For, the transverse orders of them, proceeding from the bark, and being produced through the ligneous fibres, empty themselves internally into the pith, whence they are both found to be of the same nature. But their form and magnitude are various; for, by pressing one another, where they are copiously crowded, they gain a different configuration, as oval, oblong, and angular, that they may be adapted the more easily to each other; and their colour too is various. They are composed of a smooth diaphanous membrane, and inosculate with one another †.

14. In the fabrick of herbs and trees, besides the air-vessels and the succiferous tubes, we find a

* *Malpig. p. 32.*

† *Id. p. 2. 24. 30. &c.*

peculiar small vessel, full of turpentine, gum, and sometimes of a concreted and proper juice, or humour: we can only admire the progress of this sort of vessels in those plants whose juice by concreting acquires solidity, or is tinged with different colours. But it seems very probable to our famous author, that in every plant there is a particular vessel which conveys its ultimate and specific nourishment. So that how many soever species of plants exist, so many peculiar juices may be found *.

15. Hence, trees are nothing else but small separate pipes produced, or elongated, through the earth, which are gradually collected into little bundles; and these packets being farther conjoined to others more remarkable, at length all of them being gathered for most part into one cylinder, form the trunk; whose opposite extremity, by making also a separation of its tubes, sends forth arms or branches, and by degrees the greater branches are subdivided into less, till the extension is at last made into leaves, in which it ultimately terminates. The extreme roots therefore consist of one or two tracheæ, or air-vessels, about which tubular ligneous plexuses play, which are so reticularly disposed, as that the intercepted areas are acutely angular; but as the root increases in thickness, by other small roots being united to it, transparent woody fibres, like hairs, fill the interstices

Malpig. p. 34. See *The Anatomy of Plants, with an idea of a philosophical history of them.* By Nehemiah Grew. London 1682. in folio,

interstices of the tracheæ, and are invironed with a thick and soft bark *.

§ IV.

16. The bark of trees, besides the concoction of nourishment, seems to have a peculiar office assigned it, and that is, to cause their increasing growth or thickness; as happens every year from the addition of a new covering, or layer, of fibres, which being intermixed with horizontal rows of utriculi, and gradually acquiring an hardness, at last obtain the real consistence of wood. In the *liber*, or *inner bark*, nature always produces new orders of fibres, or at least manifests by the augmentation, what parts she obliges habitually to convey aliment, by the softness of them admitting it, which, at length being become firm, she applies to the contiguous parts of the wood where-to they adhere, and so a new augmentation or increased thickness of the trunk and branches is occasioned by a zone, or ring of wood being brought upon them.

17. Whence, we may justly infer, that the principal part of trees is that portion of the bark which is joined to the wood, by whose assistance plants perpetuate life, trunks become thicker and thicker, and their germination or budding, as well as fruitfulness succeed. Wherefore, the exterior portion of the bark, which is very much decayed by the injuries of the air and transpiration, and rendered lifeless and rigid, is added for a safeguard to the *liber*,

* *Malpig. p. 11.*

liber, or *inner bark*, which also does not a little defend more interiorly the subjacent wood. Hence it is probable, that such plants as have annual stems, or which at least do not last a long time, and have no ligneous portion joined to the cylinder, are deprived by nature of a bark, and are only furnished with a cuticle, or small bundles of fibres; but in the rest, whose augmentation is required for a very considerable time, in the bark, like as in the first delineation of the stamina or rudiments, orders of ligneous fibres are prepared, and deposited in the *liber*, or *inner bark*, that they may shew themselves more increased, and emerge at a stated time *.

18. From the difference of *roots* and *buds*, the most famous *Casalpinus* † aptly enough and usefully determines, that the primary or highest genera of plants ought to be constituted, and divides them into *trees* and *herbs*; with the consent of all Botanists that have either attempted to give a general history, or method of plants, before the great *Carolus Linnaeus*; who, having rejected this division as unnatural, every where confounds herbs with trees.

“ *Gems*, (or *buds*), (*he says*) are really *winter-*
 “ *quarters*, since they preserve the tender plant
 “ through the winter from the severity of the
 “ weather. Hence it is, that the great Creator
 “ hath allotted gems to most trees growing in
 “ cold countries: but on the contrary has for most
 “ part

* *Malpig. p. 23. & 24.*

† *Lib. 1. c. 13.*

part refused them to the trees of warm regions.
 " The *Citrus*, *Fatoupha*, *Pereskia*, *Asclepias*, *Al-*
 " *ternus*, *Gerania*, *Lavatera*, *Frangula*, *Ruta*, &c.
 " are destitute of gems *." Whether all these
 are properly called trees; or such as may be pro-
 pagated by inoculation, are destitute of eyes, (or
 gems), let others judge. But he adds, " And
 " therefore Ray's and Pontedera's division of plants
 " into herbs and trees, founded on gems, is of no
 " force, since they should have known that it
 " would be absurd to take the same distinction
 " from the duration of the stem." Yet he talks
 a little differently in his Botanical Philosophy †.
 " For, *Plants*, (he says) are named *herbaceous*,
 " which perish yearly above the root; *Shrubs*,
 " when the trunk ascends above the earth with-
 " out gems; and *Trees*, when the trunk ascends
 " above the ground with gems. Gems either
 " distinguish shrubs from a tree, or we can have
 " no limits of difference, since magnitude is of no
 " moment. And, Indian trees will be called the
 " largest shrubs, because they rarely produce
 " gems: and therefore this division is not natu-
 " ral, since betwixt a shrub and a tree, only the
 " vulgar opinion, and not nature, hath set any
 " bounds." He therefore seems to admit as nat-
 ural the distinction of plants into *herbs* and *trees*,
 Which however, whether it is natural, or no, is
 of little signification, since it is extremely useful

* C. Linnæi *Aménitates Academicæ*. Vol. 1,
Lugd. Bat. 1749. Vol. 2. *Amstelodami* 1752. in
8vo. Vid. Vol. 2. p. 188.
 † Pag. 37.

in the arrangement of plants. But between shrubs and trees, as they are described by the most famous *Linnaeus*, nature herself seems to have fixed notable enough limitations in the barks. For, all trees, whether they do, or do not bear gems, are endued with a true bark, and with a *liber*, or *inner bark*, which is the principal part of them: Such plants, consequently, whose stems are not annual, but endure for some years, and are not covered with a true bark, but only with a cuticle, may be styled shrubs, or numbered with herbs.

§ V.

19. Now, the nutritious humour entering by the pores of the root, or the open mouths of its vessels, mounts upwards, and part of it at least is suspended: But, by what means, cannot be instantly told.

Since every portion, says *Malpighius*, which unites the small pieces of the fibres to each other, interiorly projects a little, it supplies the place of a little valve, so that every least drop of fluid, as if it moved by a cord, or by degrees, is raised to a considerable height. And not only do the roughness and *smallness* of the tubes promote its ascent, but also the successive changes, *viz.* from warm to cold, in the various conditions of day and night, of the temperature of the air; and its elastic movement, which urges the exterior coverings of the bark, may forward and assist the motion of the contained liquors in their ascending course. Likewise, by the dilatation of the tracheæ, from the air within them making them turgid, the interposed

posed ligneous fibres and the horizontal appendices of the utriculi are necessarily squeezed, whereby probably their contained juice is expressed into the contiguous parts: but when the swelled air-vessels collapse, the utriculi and ligneous pipes are relaxed, and more easily admit the entrance of new liquid. The ascending humour therefore is poured, like *chyle*, into the transverse utriculi; and making a pretty long stay in them, and being intimately blended and fermented with the older juice, it is exalted into the nature of aliment. For, it is very likely, that plants, by the active assistance of the air, are protruded upwards in germination, preserved in a growing state, and maintained in progressive life, that the rise and fermentation of their juices are by the same means facilitated, and many other effects produced *. But these perhaps are more owing to the humours, &c. derived from the atmosphere, than to the elasticity of the air.

20. For, neither the observed ascent of liquors in capillary tubes, sponges, &c. nor the attraction of the leaves, remove the difficulty. Because the woody tubes are not conical, but cylindrical; the expansion of the leaves is caused by the rise of the sap; and, both the *Maples*, the *Birch Tree*, the *Horn-beam* or *Hard-beam Tree*, the *Walnut Tree*, the *Willow*, and the *Vine*, bleed in the autumn, in winter, or only in the spring, while trees are despoiled of their leaves: yea, in plants which carry no leaves, as in the *upright Torch-Thistles*, the sap ascends to a great height, and that plentifully.

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* p. 22; 23. 33. 14.

But we shall leave these things to be investigated by more sagacious mechanics, and proceed to consider a question of greater importance, which here occurs.

VI.

21. Of what nature is that humour, or juice, with which plants are nourished? Does water alone suffice for this purpose, or no? And, what is the cause of the various fertility of soils? The learned do not agree concerning these matters.

About six hundred years before the nativity of Christ, *Thales the Milesian*, one of the seven wise men of *Greece*, to whom it is reported the other six having first consented, said, water was the original of all things, and that all things consist of it; but that *God* was the mind which formed all things out of water *: The last observation he perhaps took from the first book of *Moses*. That vegetables are nourished by water alone there are not wanting some who endeavour to demonstrate by experiments; among which is that extraordinary one of the willow of *Helmont*, by many authors often quoted than accurately related. His words in English are these:

That all vegetables immediately and naturally come forth from the sole element of water.

I learnt by this trial. For, I took an earthen vessel, wherein I put of earth dried in an oven

Cicero De Nat. Deorum, l. 1, & Acad. Quest. l. 4.

“ two hundred pounds, which I moistened with
 “ rain water, and planted in it the trunk of a
 “ willow weighing five pounds. And at length,
 “ when five years were expired, the tree which
 “ grew therein, weighed one hundred and sixty
 “ nine pounds, and about three ounces. The
 “ earthen vessel was large, placed in the ground,
 “ and watered with rain water only, or always
 “ with distilled water, when there was occasion;
 “ and, lest any flying dust should be mixed with
 “ the earth contained in it, I covered the top of
 “ the vessel with an iron plate soldered over with
 “ tin and made full of holes. I did not compute
 “ the weight of the leaves that fell off in the four
 “ autumns. At last I again dried the earth in the
 “ vessel, and found only about two ounces want-
 “ ing of the two hundred pounds. (Therefore one
 “ hundred and sixty four pounds of wood, barks,
 “ and roots, had sprung from water alone.” Thus
Helmont *.

The illustrious *Boyle* likewise took the trouble
 to sow, in some earth dried in an oven, a seed of
 a certain Indian pumpkin, or melon, which, in the
 space of five months, grew up into a plant weigh-
 ing four pounds and three quarters; and found that
 the earth when dried again had lost nothing of its
 former weight.

“ Nor are the experiments of the most illustri-
 “ ous *Boyle* (says Mr. *Geoffroy*) of less moment than
 “ that of *Helmont*, which has been often repeated
 “ by others, and they are far more accurate. He
 “ put sprigs of Mint, Marjoram, Pennyroyal, and
 “ Balm, into bottles filled with limpid water, and
 “ the

"the sprigs of three drachms or half an ounce in weight, increased to six ounces and upwards ; which being afterwards distilled did not afford a less quantity of principles, than branches of plants which were planted in a fat earth *."

22. It is also very well known to persons skilled in agriculture, how much breaking the earth into small parts, forming it into heaps, exposing it long to the sun and open air, sheltering it with hedges of living plants, &c. conduce to its fruitfulness, without any manure : *It is likewise often advantageous to burn barren fields.* I made various experiments, with sal ammoniac, sea-salt, nitre, quick-lime, &c. in order to discover what they contribute to the fertility of soils ; and briefly,

I found, (1) That one part of any of the above mentioned salts, dissolved in somewhat more than ninety parts of common water, killed mint planted in it : the solution of sal ammoniac indeed destroyed it in the space of one night ; that of nitre in a week ; but that of the marine salt much later, *viz.* the part of the mint under water, for that part of it which was above the water, withered in the same time as in the solution of nitre. (2) That small and lean earth, as being very sandy, and taken out of earthen pots in which shrubs had grown for some years, and only sifted, nourishes plants as well, and seeds come up in it as vigorously, as in the fattest earth, and are less infested with insects. (3) That the same lean earth, mixed

* *Geoff. Mat. Med. Vol. 1. p. 9. See Boyle's Works, Vol. 1. p. 312. &c. and Vol. 2. p. 498.*

mixed with a thirty sixth part of calx vive, kept dry for a year, made it worse, and less fertile, by almost a third part. For, a plant set in it, at the end of seventy four days, weighed six drachms and fifty grains; while the weight of another plant, of the same kind and equal size, which grew in the lean earth without quick-lime, in the same space of time, amounted to nine drachms and twenty four grains. (4) That lime-water does not corrupt bulbs of the Hyacinth and Tulip, though macerated in it for many days: but that the root of the Oriental Hyacinth with a blue flower, put into a glass of this water, immediately languishes; neither its leaves nor stalk attain their usual length, its flowers turn red, and are not fully expanded; and the fibres which it had before sent out are soon consumed. And (5) That shrubs and herbs kept in earthen pots, and watered for many months with this lime-water, neither grow more vigorously nor more languidly, as far as I could observe.

And therefore I am forced to conclude, that we cannot easily arrive at the knowledge of the precise nature of the humour strained from the earth, for the successful advancement of vegetation, if it be different from water. For, the fertility of soils is more promoted by *aphairesis*, than *prosthesis*; viz. by subtracting or removing those things that hinder it, such as too much moisture or dryness, solidity or lightness, hardness, roughness, sourness, coldness, insects, hurtful weeds, &c. than by adding those things which are defective; or what water and air, assisted by heat, cannot supply.

§. VII.

23. There was published at *Leyden* in 1743, in 4to. *A Dissertation*, in which the physical question, *What is the cause of the fertility of soils?* proposed by the *French Academy* at *Bordeaux* in 1739, is treated of by *John Adam Kübel*, M. D. and by it he obtained the appointed reward of a golden medal. But it seems to be supported by hypotheses, and not sufficiently by sure experiments. For, in Thesis 8. he thus argues, "Since the substance of vegetables not only consists of fluid, but likewise of solid or terrestrial parts, it thence follows, that the nutritious juice of vegetables ought to be composed also of terrestrial parts, which the earth yields it out of its bosom." But he himself below acknowledges, in Thes. 39. that these terrene parts may be derived from water: For, he says, "By examining the matter more thoroughly, it will be found, that water wholly furnishes out of its lap, the solid particles necessary to increase the substance of vegetables."

24. Then, in Thes. 10. "Since the terrene portion of the nutritious juice, *he says*, must be very subtile, and especially dissolvable in water, and the earth furnishes it out of its bosom, it hence may be inferred, that *that peculiar disposition of the earth*, by which one field is usually more fruitful than another, consists in this, that the more fertile abounds with greater plenty of that subtile earth, which is soluble in water; but the more barren field contains very little;

" little, or none at all of it, unless it be artificial-
 " ly supplied with it by dungs." To confirm
 this allegation he recites an experiment, on which
 his whole opinion, or the solution of his question,
 depends; which is thus propounded, in Thef. 11.
 13. 14.

" To prove, *he says*, the truth of the assertion,
 " I took earth that was vastly fertile and without
 " ordure, and poured hot water on a portion of it;
 " the lixivium I filtered through blotting paper
 " and reserved it. I again extracted with more
 " hot water what I could from the remaining
 " earth, nay, I boiled it a little; the extract I
 " filtrated and mixed with the former. I repeated
 " several times this extraction of the same earth,
 " and at length I so concentrated all the extracts
 " in glass platens, by gentle evaporation, that of
 " *some measures* of them, only one pound did re-
 " main. The concentrated extract was of a dark
 " brown colour, and had let fall during the eva-
 " poration much of a *subtile and unctuous earth*,
 " found on the sides and bottoms of the glasses;
 " and the surface was covered with a kind of cu-
 " ticle, such as saline lixives commonly form while
 " they are evaporating. If it be gently evaporated
 " to dryness, *an unctuous saline magma* is obtained, of
 " a brownish red colour; but if it be again dissolved
 " in water, filtrated, and gently evaporated, it be-
 " comes pellucid, and acquires a more elegant co-
 " lour, and deposits no longer any thing terrestrial,
 " how often soever it be still dissolved. The same
 " experiment succeeds with all fertile earths, so
 " that by how much the more fertile any earth is,
 " it supplies water with so much the more of the sub-
 " tile substance. Yet it does not succeed so readily

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“ with the intirely muddy, clayie, sandy, and
 “ other barren earths, because they communicate
 “ very little, or sometimes absolutely nothing, to
 “ a watery menstruum. Hence it follows, that
 “ the specific difference in the nature of fertile
 “ and barren earths consists in this, that those con-
 “ tain much, and these but little or none, of a sub-
 “ tile terrestrious substance which is soluble in
 “ water.” Thus Dr. Kübel. But the oration
 seems to be lame.

25. For, (1) The quantities of the fertile earth;
 and of the water which the learned *Author* used,
 as also of the unctuous saline magma, are wrongly
 omitted to be mentioned; for, what a portion of
 fertile earth, and some measures of water denote,
 I cannot imagine. But besides, (2) He did not try,
 whether “ grain and corn would grow more vi-
 “ gorously and more plentifully in his unctuous sa-
 “ line magma,” by itself, or mixed with sand,
 than in any other earth, or than in the earth re-
 maining after (his first at least) extraction. For,
 an eminent writer on husbandry, *Jethro Tull*, re-
 marks, “ That nitre and other salts, afford no bet-
 “ ter nourishment to plants, than arsenic does to
 “ mice.” If indeed either of those things had
 happened, it would have been needless to have
 prosecuted any farther his inquiries.

I took of earth, fertile both by art and nature,
 eight pounds, four pounds of which I diluted with
 more than four times the quantity of water, I stir-
 red it strongly and for a long time with a stick,
 and after a maceration of five days, I poured off
 the water, and moderately dried the earth. In
 this washed earth, I planted nine seeds of the com-
 mon

mon cucumber, and as many of the garden radish; and at the same time, I sowed an equal number of the same seeds in the other four pounds of the same earth unwashed, but sufficiently wetted. Yet they did not grow in the least more vigorously or more copiously in this than in the other: nay, on the contrary, they vegetated more vigorously and plentifully in the washed than unwashed earth, especially the seeds of the cucumber. It will perhaps be objected by some, that all the subtile and unctuous earth cannot be extracted by cold water, but by boiling, and repeated affusions of it. But what can be only thus extracted from earth, will certainly never be extracted by the roots of plants, or constitute a part of the nutritious juice. The assertion therefore of our author, with submission to the illustrious Academy, and the celebrated *Carolus Linnaeus* *, is not at all proved by this experiment, nor can it be proved by any means as far as yet appears. Consequently we need not be solicitous about the analysis of this magma, howsoever imperfectly it is delivered.

26. Lastly, in Thes. 34. it is thus written,
 “ Yea, this unctuous earth owes its original pro-
 “ duction to the vegetable kingdom.— Yet, it
 “ is from thence manifest, that it was naturally
 “ bred in the earth from the beginning of the
 “ creation, because there are fields in their own
 “ nature so fruitful, that they evidently want
 “ no assistances from dungs.” Which indeed
 seems plainly to contradict the hypothesis of our
 famous author. That there are such fields, is not

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* *Phil. Bot.* p. 88:

to be denied: but we are not hence to conclude they are therefore fertile, because they abound with that unctuous earth; for, though they only consisted of such an earth, this would in time be necessarily consumed: and such fields are rather to be reckoned fruitful, because no impediment to vegetation exists in them, and they require to fertility, only the assistance of water, air, and heat, as is confirmed by the above-mentioned (No. 22.) experiments.

§. VIII.

27. We meet with a still more recent, and more obscure account of vegetation, in the *Histoire Physique*, lately and first printed at *Paris*, and afterwards reprinted at the *Hague* in 1750. in 4to. which, if I understand the author, is to this purpose*:

Since salts and some other fossils are composed of parts, both exactly like their own, and those of the body which they constitute; a grain of sea salt being a cube, consisting of infinite other cubes; plants which have a power to produce others like themselves, from all parts of these things, are organical bodies, composed of other exactly similar organical bodies, whose primitive and constituent parts are likewise organical, not indeed perceptible to the eye, but by reason and analogy; hence we are induced to believe, that in nature really exist an infinity of organical living parts, of the same substance with the bodies which they constitute. For, as perhaps thousands of thousands, of small saline

* Tom 2. c. 2. p. 8.

saline cubes, are to be accumulated, to form one sensible grain of sea-salt; so thousands of thousands of organical parts, exactly similar to the whole, are required, to form even one of the buds which one individual elm contains.

"To me therefore, *he says*, it appears very likely, that there actually exists *in nature an infinity of small organical beings*, quite similar to the great organical beings conspicuous in the world; that those small organical existences are composed of living organical parts, common both to animals and vegetables; that these organical parts are *primitive and incorruptible*; that collections of these parts form visible organical existences; and consequently, that *reproduction*, or generation, is only the change of form, which happens and is brought about by the sole addition of perfectly similar parts; as also the *dissolution* of an organical being, proceeds from their separation." An opinion indeed ambiguous from a tedious and intricate detail of words, if different from that of the schools, concerning the *materia prima* and substantial forms.

28. For, 1st, It seems difficult to tell what he means by *organical parts*. Because they are all, either always of the same determinate figure, or constitute equally well an elm, or a cabbage; and then they differ in no respect from the atoms of the Epicureans, and a knife will consist of organical parts: or, the figure of those in the elm, differs from that which they have in the cabbage; but if so, an elm could not be nourished by a cabbage, howsoever putrified, which is not true.

2^{dly},

2dly, He calls these organical parts *incorruptible*: and in one sense all matter may perhaps be said to be incorruptible; but then there would be no distinction between organical and non-organical parts, or betwixt organical bodies, and rude (*corps bruts*) or non-organical bodies. However, either all the parts of vegetables are organical and incorruptible, or only some of them. If all are so, then all the parts of water are also organical and incorruptible; since by far the greatest share of vegetables is the mere element of water. If only some of the parts of vegetables are organical and incorruptible; these must necessarily be a chemical earth, or water; since all vegetables and their constituent parts, can be resolved by art into water and earth. And if the parts of water and a chemical earth are organical, there is no matter, or body, whose parts are not organical.

3dly, It is also expedient, that these organical parts be *living*. I shall not here explain in how many different senses the word *life* is taken. Our author however, unless I am mistaken, means by it the power, or faculty, of spontaneous motion. But how any part of matter can move itself spontaneously, unless it be likewise endued with an elective power, or will, I do not see. For, since of itself it equally tends upwards and downwards, to the right hand and to the left; at least no reason can be assigned, why such a particle of itself will move in one direction, rather than in any other: therefore, unless it be determined by some other cause, or can determine itself, it will never move out of its place. Besides, since these parts are *exactly alike, and of the same substance*, if one
of

of them be supposed from its own nature to move upwards, they will likewise all move themselves upwards; and so never constitute an organical body. For, since to form even one bud of an elm, thousands of thousands of such organical parts are required, by no means does their conjunction suffice, nor their simple cohesion, by what power soever it be accomplished; but they should be disposed only in one, certain and definite order, of the infinite possible orders, that thereby the various vessels, &c. may be formed, and placed in that wonderful manner, as is observed in such a bud. To effect which, evidently another energy and design, yea more than human reason, is requisite, which the author I scarce expect will find in his organical parts, though he should feign that they both feel and think.

29. Nor will his feigned internal modes, or interior forms*, though they did exist, extricate him out of his labyrinth, unless he would also give them a directing, applying, and conjoining power, as well as exterior modes keeping these organical parts in order; and of all of them more than an infinite variety. I have called them feigned forms, because I am entirely ignorant to what kind of beings they belong, since they are to be named neither spiritual, nor material. The analogy also of such modes, with gravity, seems to be very far fetched. For, let gravity be a quality in nature, or an exceedingly active power, and intimately pervading the smallest particles of bodies; which, however, is difficultly proved; since

* *Modes intérieurs*, l. 6. p. 15.

since it is not less philosophical to affirm, that those things are performed by impulse, which are ascribed to gravity, than by attraction *. However, if it be a quality, it is inherent in every particle of matter, and its force is every where uniform. But, the supposed modes are neither inherent in all matter, nor in any simple organical part, nor in the great organical bodies themselves, nor is their influence uniform; and if they are modes of substance, they subsist without substance, or may subsist.

30. And, 4thly and lastly, These organical parts ought to be *primitive*; that is, unless I am deceived, produced at the beginning; viz. at that time, when a comet being rapidly projected towards the sun, shook off from its body those small particles, of which the earth was formed, together with the other planets, and their satellites; to all which, by the force of percussion and inherent gravity, it communicated the motion and order, which they retain to this very day. At that memorable time, I say, when from the substance of the sun, liquified by the most intense and wave-like heat, the sea was produced, or so great a collection of waters covering the earth, that the tops of the highest mountains did not stand up above it, till after, I know not how many, ages of ages †.

That birth-day of the world will now never be forgotten; nor can the shoals of fishes that inhabit the sea, be robbed of that dignity derived from their ancestors, which is peculiar to them above

* Vid. *Newt. opt.* p. 351.

† Vid. *Hist. Phys. tom. 1. p. 47. Sec.*

petrified bodies, called animals? Whence is it that vipers are to be found in a rock in the island *Melita*? Why are all these wreathed in the same manner, and with their heads seemingly cut off? Perhaps these, as also innumerable lapideous plants, to be met with almost every where, are of the same age with the shells of shell-fish: and, if it be so, the singular hypothesis of our author will be overthrown, or, in other words, without a support.

32. "A certain heterodox divine, *he says*, whose head was very much heated with poetical visions or dreams, believed that he had seen the creation of the world, &c.*" And certainly nothing can be so absurdly said, that is not said by one or another of the philosophers. But the most violently heated head, among the poets, never invented a more absurd fiction, than that of our Catholic philosopher concerning the origin of the world, without creation, or rather by a mechanical or fortuitous production of the planets; as if it was unworthy of natural philosophy, to admit any supernatural cause, or to have recourse to the first cause, when, in any way soever, all second causes are wanting. That philosopher thought far otherwise, who, in treating of the world, speaks thus: "It remains that we discourse briefly concerning the continual cause of all things: for, it would be absurd and wicked to treat of the world, and silently overlook what is most excellent in it. It is therefore an old saying, transmitted by our fore-fathers to all men, that all things were appointed from, and made by, God. For, there

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* *Vid. Tom. 1. p. 24.*

“ is no nature which is sufficient of itself to pre-
 “ serve itself without him, who is the *creator*
 “ and *preserver* of all things in the world, and
 “ who compleatly forms all things without diffi-
 “ culty, and by simple motion. In short, what
 “ a pilot is in a ship; what a charioteer is in a
 “ a chariot; what a precentor is in a chorus;
 “ what, lastly, a law is in a state, and a general
 “ is in an army, that God is in the world; who
 “ finishes all things without labour, without trou-
 “ ble, or bodily infirmity, &c.*” But to return
 from this digression.

§ IX:

33. That the nourishing juice is derived from the root in a progressively direct or straight motion to the tops of the tallest trees, is sufficiently clear; nor do many experiments permit us to doubt of its return or regress, and lateral motion. But, whether it both ascends and descends by the same, or by different vessels, or whether there is a circulation of the humours in plants, is not equally certain. However, by mixture, digestion, motion, perspiration, or some other unknown property of the organs, the non-natural juice is concocted into the nature of every vegetable, or rendered natural.

But, concerning the formation or production of gems or buds, I am of the same opinion as *Malpighius* entertains concerning the little seminal plant; viz. that their generation is to be deemed one of the secrets of nature. For, as far as I could yet collect from observations, the embryo in a gem,

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viewed

* *Vid. Aristot. de mundo, c. 6.*

viewed with a microscope, no otherwise than in a seed, at the first inspection appears in the form of a thin membrane, or pellicle, turgid with an aqueous humour; from this, utriculi and at length fistulous fibres are formed, which by vegetating are indeed scarce at all or little increased in thickness, but much in number and length. And almost the same thing may be said of the annual coat, or increase of trees. For, the liber or inner bark in the spring time abounds with juice, from which first vesicles, then pipes, and at length a new liber or internal bark arises, when the interior part of the former applies itself to the wood, and is hardened in time into a new woody covering. From this new coat, as it were from a proper matrix or womb, the gems of the following year, at least in our own country, come forth; and by no means from the pith of the tree, as some would have it.

§ X.

34. The second great work of a vegetable is, to generate another like itself; which is principally performed by fructification; whose parts are the *Calyx* (or Flower-Cup), the *Petalum* (or Flower-Leaf), the *Stamen* (or Chive, or Thrum), and the *Pistillum* (or Pestil).

35. The *calyx*, or *flower-cup*, is the basis and prop or support of the flower, and by the fashion of its body cherishes and infolds the beginning rise of the leaves and stamina, and also for most part covers over their progress; wherefore it is endued with a various or manifold form and magnitude.

nitude *. "The calyx should be termed the
 "posterior part of the flower, distinguished from
 "the foot-stalk by a certain remarkable thickness,
 "either involving, or sustaining the flower-leaves,
 "or serving both these purposes. But, since it is
 "often a great knot, and those flowers that have
 "a calyx, should be differenced from those that
 "want it; therefore, the leaves of flowers, of
 "whatsoever colour they are, should be esteemed
 "the calyx, when they become the proper invo-
 "lucrum (or covering, or receptacle) of the seed;
 "but are to be reckoned petala when this does not
 "happen, whether they die soon, or continue.†"

But, according to the most famous *Linnaeus*, in
 his *Fundamenta Botanica* (§ 86. a.), there are
 seven species of the Calyx: viz. *Perianthium*, *In-*
volucrum, *Spatha*, *Gluma*, *Amentum*, *Calyptra*, *Volva*.
 And his *Genera Plantarum* ‡ (in the edition of
 1742) contains 1021 kinds. Of these kinds (f. i. c.)
 673 have for a calyx a *Perianthium*, 72 a *Spatha*,
 65 an *Involucrum*, 29 *Gluma*, 18 *Amentum*, 3 *Ca-*
lyptra, none *Volva*. In his *Phil. Botanica*, p. 52.
 the *Volva* is described, "to be the membranous
 "cup of a musbroom, ragged or torn on every
 "side." But, in 11 characters of the genera of
 fungi, there is no mention made of the *Volva*.
 And about 110 genera want a calyx; while some
 (about 25) have both a *Perianthium* and an Invo-
 lucrum; others a *Perianthium* and *Spatha*, &c.

Besides,

* *Malpig.* p. 56.

† *Tournefort. Inst.* p. 71. 72.

‡ *C. Linnæi Genera Plantarum, eorumque Cha-*
acteres naturales. Lugd. Bat. 1737. Editio secunda
aucta et emendata. ibid. 1742. in 8vo.

Besides, the calyx of the *Costus* is a simple spadix, or simple spathæ, or a perianthium with three teeth: the flower-cup of the *Xyris*, *Cyperus*, *Scirpus*, *Eriophorus* is a spica, or ear: the calyx of 44 umbelliferous genera is an umbrella, &c. Of the *Morinda* and *Eryngium*, a receptacle: Of 85 genera of syngenesious plants, it is a common, or universal, or compound calyx: The calyx of the *Platanus* consists only of some very small lappets, or jags; that of the *Trichomanes* is copped, or broad above and small below; that of the *Anthoceros*, *Blasia*, *Lemna*, consists of one leaf; that of the *Chara* of two very small leaves; the whole margin of that of the *Fuchsia* surrounds (the lower half of the pistillum, which he calls) the germen; and so on. There are therefore many more species of calyces than seven. Yet, in the mean time I do not see what use such minutæ, or little niceties, is of; since scarce any one can know in any other way what is meant by the species of a calyx, or a pericarpium, or a receptacle, than by looking at and examining the plants themselves; and by this means he will easily acquire a sufficiently clear and distinct idea of every calyx, &c. though he should have never heard of the above-mentioned sorts of it.

36. The *petala*, or *flower-leaves*, are those leaves which for most part excel the other parts of the flower in shape, or beauty and colour, and which never become the proper seed-vessel, or involucre of the seed. *Papius Columna* was the first, as far as I know, who used the word *Petalum*, to distinguish the leaves of flowers from those parts properly

properly called *folia*, or leaves *. They are called by some *flores* simply, or the flowers, and by others *florum bractea*, or the thin glittering leaves of flowers.

Now, since we likewise meet with in some flowers as it were secondary petala, distinct enough from the former, which in the *granadilla* are by *Tournefort* called *Corolla fimbriata*, in the *hellebore* *Cornicula*, in the *nigella* *Corolla*, in the *aconitum* *Styli duo*, &c. and in general by *Linnaeus*, *Nectaria*; it is useful, to express by one general name both these sorts of petala; and such a one is the *Corolla* of *Linnaeus*: but, because this word denotes many different things among the Latins, perhaps it might be more fitly changed for *Anthus*, in imitation of *Columna*, or with *Jungius* named *Bractea*. However, "There are two species of the *Corolla*, the *Petalum* and *Nectarium*; and four parts of it, *Limbus*, *Tubus*, *Lamina*, and *Unguis*.†"

37. The *Stamina*, or *chives*, or *thrums*, are those small bushy threads, which usually possess the middle of the flower and support the apices. The *Apices* are the uppermost, thicker, tumid, hollow parts of the *stamina*, like receptacles, which are for most part divided into two apartments, and bivalve or open two ways ‡. *Casalpinus* calls the *stamina* *Flocci*; and their apices *Linnaeus* names *Antheræ*. "When the round body with which the slender heads of the *stamina* are

* *Tournefort*, p. 70.

† *Phil. Bot.* 86. ii.

‡ *Tournefort*, p. 70.

“are crowned become turgid, and the containing
 “capsula (or bag, of each apex) is dried, very
 “small globules burst out and are dispersed abroad.
 “These globulets, or as it were atoms, are of
 “different figures and colours, but they frequent-
 “ly have a yellow colour*. The stamina rise
 “either from the calyx; or, and that the most
 “frequently, from the petala; or, from the em-
 “bryo of the fruit. The Antheræ adhere to the
 “stigma (or upper extremity of the pistillum) with-
 “out filaments in the *Aristolochia*.” Phil. Bot.
 p. 73.

38. The *pistillum*, or *pestil*, *Tournefort* calls that part which commonly occupies the center of the flower amidst the stamina, and is multiform †. The *Stylus*, with *Malpighius*, is the part occupying the center of the flower, which incloses the seed in its cavity, rises up with an appendix, and plays among the stamina. It is known, that the parts of flowers are ingeniously formed for the sake of the stylus, or uterus; for, in this the seed, which is at the last demanded by nature, is curiously guarded ‡. The appendices of the Stylus, *Cesalpina* || calls stamina ||||.

Fructification, which are for most part divided into two parts.

* *Malpig*: p. 63. 64.
 † p. 70.
 ‡ p. 64.

|| l. I. c. 7.
 |||| *Malpighius* not only calls the whole pistillum, the style, or womb; but sometimes its inferior half ovarium, and its superior appendix ovarii.

“ Fructification, is a temporary part of vegetables, dedicated to generation, which ends an old, and begins a new work. Seven parts are appropriated to it. 1. The *calyx*, which is the bark of the plant present in fructification. 2. The *corolla*, or the inner bark of the plant present in the flower. 3. The *stamen*, a bowel for the preparation of (*what is supposed to be the impregnating*) powder. 4. The *pistillum*, a bowel adhering to the fruit for the reception of the (*dust, or*) powder. 5. The *pericarpium*, a bowel pregnant with seeds, which it scatters when ripe. 6. The *seed*, a part that falls from a vegetable, the rudiment of a new one, which is vivified by the irrigation (*prolific influence*) of the powder. 7. The *receptacle*, the basis by which the six parts of fructification are connected together.” Thus much from the *Phil. Bot.* p. 52. But how justly it is grounded, will appear from the sequel. I shall only add here, that he makes three parts of the pistillum, viz. the *Germe*n, (*or, lower half of it*) the *Stylus*, (*or, greatest share of the upper half*), and the *Stigma*, (*for, he so calls the top, or superior extremity of the Pistillum,*) to which the description of the Pistillum seems only to agree.

§ XI.

39. With respect to what belongs to the texture and composition of these parts, the substance of the interior little stem, or footstalk, as *Malpighius* informs us, viz. the pipes and tracheæ, are extended and elongated into the leaves of the flower, which

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are

are furnished with every kind of vessels, and perfected by hanging series, or rows, of utriculi. For most part the vessels do not go forth from a little side, but copious small bundles of them rise up from the base, and having produced branches they are elongated in all dimensions. In the same manner also, each of the stamina is made up of ligneous fibres and air-vessels, to which the utriculi, or little bags, placed longitudinally, are added *.

All the before-mentioned parts do not occur in all flowers: for, some want the involving calyx, others the petala, and others the pistillum; while, in all fertile flowers, both the pistillum and the apices of the stamina are always present; which therefore appear to be the most essential parts. But concerning the use of the apices, and their dust, Botanists do not yet agree.

40. For, *Casalpinus* † says, “ The *Oxycedrus* and the *Taxus*, bear fruit, but do not flower; and, of the herbaceous kind, the *Mercurialis*, *Urtica*, and *Canabis* do the same; of all which they call the barren, *males*, but the fruit bearing, *females*. Yet, of the former kind, or males, they say that the females thrive better, and become more fruitful, if they are planted near them, as is observed in the Palm Tree; as if a certain vapour, breathed out by the male, compleatly disposed the slack heat of the female to fructification.”

And *Ray*, “ What the use of these parts is, is doubted: some think they are given to flowers
“ for

* *Raii Hist. Pl.* p. 16.

† *l. l. c. 7.*

“ for the sake of ornament ; and others, to discharge the matter which retards the production of the seeds, that the residue may become purer and freer of dregs, and therefore are as it were emunctories. But our *Grew*, is of opinion, that the stamina not only have this use, but likewise *thinks* that the powder, or globules, with which the apices are filled, and which at maturity they throw out like male sperm, serves to fecundate the seed ; and therefore that most plants partake of both sexes.*”

Grew's opinion pleased very many Botanists ; and first of all *Ray* † ; next, *R. Camerarius*, &c. yet some of them, without mentioning the author's name, delivered and boasted of it as their own ; especially *Mr. Geoffroy* ‡, and *Mr. Vaillant* ||. And others earnestly endeavoured to establish it by various arguments, as *Ray* himself, *Camerarius*, &c. But among all these the celebrated *Linnaeus* shines ; who writes thus :

“ That the antheræ and stigmata constitute the sexes of plants, was discovered, and has been described, and received as an infallible truth by those that cultivated palm-trees, by *Millington*, *Grew*, *Ray*, *Camerarius*, *Geoffroy*, *Morland*, *Blair*, *Jussieu*, *Bradley*, *Royen*, *Logan*, &c. nor can it be concealed

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* See *Grew's Anat. of Plants*, p. 171. and *Raii Hist. Pl.* p. 17.

† See the last cited place, and the preface to his *Sylloge exter. Stirp. edit.* 1694.

‡ *Memoires de l'Acad. des Sciences*, An. 1711.

|| *Sebastiani Vaillant Sermo de structura florum. Lugd. Bat.* 1718. in 4to. See this tract passim.

“ cealed from any one who will view the flowers
 “ of every plant with open eyes ; as is demon-
 “ strated in the *Sponsalia Plantarum*, printed at
 “ *Upsal* in 1746. in 4to. *” And elsewhere,
 “ That the generation of vegetables is finished
 “ by means of the fall of the powder of the antheræ
 “ upon the naked stigmata, whereby the powder
 “ is broken, and breathes out a *feminal aura*,
 “ which is absorbed by the humour of the stigma,
 “ the sight, proportion, place, time, showers, those
 “ that cultivate palm-trees, nodding flowers, such
 “ as are sunk under water, syngenesia, yea, the
 “ proper inspection of all flowers, confirm † ;”
 which is talking positively enough.

§ XII.

41. Yet, on the other hand, the most famous *Tournefort* and *Pontedera*, howsoever properly they viewed and contemplated flowers, admit no such generation, or use, of the powder. *Pontedera* indeed expressly asserts, that the liquor of the apices is not necessary, in all plants, to the fecundation of the embryo ; and endeavours to evince it by many considerations ‡. But it is plainly demonstrated by the experiments of *Camerarius* himself.

For, if one fruit-bearing plant, or solitary female of Hemp, or Dog's Mercury, or Spinage, cultivated out of any contagion of, or communication

* *C. Linnæi Systema Naturæ, editio sexta, Lipsiæ*
 1748. in 8vo. vid. p. 216.

† *Phil. Bot.* § 145.

‡ *Vid. P. Anthol. l. 2. à p. 107. ad 185.*

nication with, a neighbouring male, produces fertile seeds; then the powder, or liquor, of the apices, is not requisite to the fecundation of the embryo in all plants: now *Camerarius* * saw a solitary female plant of Hemp, and Dog's Mercury, and Spinage, cultivated out of the infectious influence of any neighbouring male, produce fruitful seeds: Therefore the liquor of the apices is not necessary to fecundate the embryo in all plants. But that the generation of vegetables may be brought about without the falling down of the dust of the antheræ upon the naked stigmata, the sight of *Camerarius* declares and confirms; and I myself have also seen the same thing. For, in the spring of the year 1737, I transplanted from one part of the garden into another, at the distance of about two hundred and forty English feet, between which parts, five, pretty high, thick, and living hedges intervened, three new young plants of the *Spinacia vulgaris* T.; and before any Spinage had begun to grow into a stalk. By accident, all the three were fruit-bearing plants, and yielded plenty of prolific seeds; for, when sown, they sprung and grew as well as any seed of Spinage is wont to do. Hence I began to doubt of this Theory.

42. And, that I might be still more assured, whether the dust of the apices contributed to the fruitfulness of seed, I made trial of the *Mercurialis* and *Cannabis* J. B. and found that one solitary female of the former, distant from all males more than two thousand feet, and one of the latter removed from all others above a mile, nevertheless

abounded

* *Miscel. cur. Dec. 3. an. 3. app. p. 31.—40.*

abounded with fertile seed. *Tournefort* * observed the same thing in Hops, *Philip Miller* † in the Bryony, and *Geoffroy* himself ‡ almost the same in the Dog's Mercury. I therefore pronounce the assertion of the most famous *Pontedera* to be a most certain fact. But, let us hear the *Sponsalia Plantarum*.

“ Yet it sometimes happens, that the seed bearing
 “ Hemp carries one or two staminiferous flowers,
 “ by which some females may be impregnated ;
 “ which deceived *Camerarius*.” Thus Mr. *Wahl-
 bom* ||. This is certainly to deceive remarkably,
 not to say any thing more harsh. Such flowers I
 never saw in the seed bearing hemp, nor did I
 ever before hear of them. In my plant, he cer-
 tainly never saw them, nor in the others above-
 mentioned. This seems to cut, and not to untye
 the knot. And, if that is the case, authority
 against tried experiments is of no avail, nor ar-
 guments drawn, from *place, time, &c.*: yet, some
 of these I shall examine and endeavour to over-
 throw.

§ XIII.

43. 1st, The most trite argument is that taken
 from the *castration* of flowers, as they love to
 speak.

* p. 69.

† *The Gardener's Dictionary*. By *Philip Miller*.
Sixth Edition. London 1752. in folio. The same
 abridged by the author. *Fourth Edition*. London
 1753. 3 Voll. in 8vo.

‡ *Mem. de l'Acad. des Sciences*, an. 1711.

|| *Amén. Acad. Vol. 1. p. 99.*

speak: "If we take away the antheræ of any
 " plant which bears only a single flower, and take
 " care that no other plant of the same species be
 " with it, the fruit miscarries, or at least it brings
 " forth subventaneous (*or barren*) ova, (*or seeds*);
 " which is so certain, that any one may try it with
 " uninterrupted success *." This is certainly
 gratis dictum, since he cannot say that he has tried
 it in all such plants: and though this be granted,
 it proves nothing; because a wound in an other-
 wise necessary part, or the loss of juice, might be
 the cause of the abortion. "Having often pulled
 " off the leaves of a flower, before they were
 " opened, particularly in the *Tulip*, I waited to
 " see whether the stylus would afterwards grow;
 " and sometimes I observed that its growth was
 " hindered, and sometimes that some seeds, hav-
 " ing suffered no harm, arrived at their due mag-
 " nitude †." But moreover, I tried the experi-
 ment with no success: for, (in the beginning of
 the last summer, viz. 1752) I took away from two
 Tulips growing together, all the antheræ, while
 they were unripe and intire, the petala, as must be
 observed, being still shut, which I cautiously
 opened a little; notwithstanding this, they both
 ripened the fruit, which was loaded, as it usually
 is, with seed, though there was no other Tulip
 in the same division of the garden, and which was
 inclosed with living hedges. But when in a for-
 mer year, from two Tulips growing in the same
 place, together with the apices, the stamina were
 also plucked off, the fruit of both of them became
 abortive."

* Spens. Pl. p. 86.

† Malpig. p. 70.

abortive, or withered, and afterwards ceased to grow. See *Philip Miller's* experiments on Tulips, in his Dictionary under the word *Generation*, near the end.

44. 2dly, Another argument is drawn from the culture of palm-trees. *Theophrastus* says, "That the fruit can never continue on the female palm-tree, unless the flower of the male has shaken its powder over it; and this indeed some say, is truly peculiar to it; but it is like the caprification" (or, bringing to maturity the fruit of the wild fig-tree, with the help of the wounds of insects, or gnats, which feed upon its juice, by planting it in a place where these animals breed, or collecting and throwing them into the tree, whose figs unwounded would frequently fall off unripe;) "of fig-trees, by means whereof their fruit is brought to perfection. Therefore any one will affirm that the female is not able of itself to perfect it. Yet this ought to appear not in one, or two, but even in all, or most kinds. For, we thus judge of the nature of the kind. And though there are few kinds of the palm-tree, it is surprising that no account can be given of it, since the cause of caprification is thought to be conspicuous *." And elsewhere, "The male palm-trees are of service to the females. For, hereby the fruit is made to continue and ripen. Whence it is said, by a certain analogy, to caprificate: It is done in this manner. While the male is in flower, the involucrum or covering out of which the flowers come being cut away, they immediately shake the flower, which

* *De caus. pl. l. 3. c. 23.*

“ which consists of a flowery substance, and down,
 “ and powder, over the fruit of the female. She
 “ is so affected by this asperision, that she never
 “ loses her fruit, but preserves all of it. Both
 “ the male fig-tree, and the male palm-tree,
 “ seem to lend their assistance to their respectlye
 “ females: for, the females are called fruit-bear-
 “ ing. Indeed, in the palm-tree, coition is as it
 “ were performed; but in the fig-tree it is caused
 “ by other means.*” What we meet with among
 the moderns upon this subject, it would be tedious
 to transcribe. The Reader, if he pleases, may
 consult *Jo. Leo* †, *Alpinus* ‡, *Mustapha* ||, *Kamp-*
fer |||, *Labat*, *Ludwig*, &c.

45. But *Herodotus* deserves to be heard, since
 he first of all, even more than a hundred years be-
 fore the birth of *Alexander the Great* **, wrote
 concerning the culture of palm-trees. “ In the
 “ fields of *Babylon*, (he says), fruit-bearing palm-
 “ trees chiefly grow; from which they not only
 “ procure food, wine, and honey, but likewise in
 “ the same manner as fig-trees are managed. For,
 “ they tye the fruit of those palm-trees, which

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“ the

* *De hist. pl. l. 2. c. 9.*

† *Harris's Collect. vol. i. p. 347.*

‡ *Prosperi Alpini de Plantis Aegypti liber, cum
 notis Vesslingii. Patavii 1640. in 4to.*

|| *Tournefort, p. 69.*

||| *Engelberti Kampferi Amoenitatum exoticarum,
 politico-physico-medicarum, fasciculi quinque. Lem-
 goviæ 1712. in 4to. Vid. p. 706.*

** *Vid. Spons. pl. præf. p. 61.*

“ the Greeks call males, to the glandiferous (or
 “ fruit-bearing) palm-trees, that a gnat (*Culex*)
 “ which enters them may ripen the fruit, lest it
 “ fall down from the tree. For, the male palm-
 “ trees bear gnats in the fruit, as if they were ca-
 “ prificous.” Thus *Herodotus* in *Clio*, as it is de-
 livered by *Bodæus à Stapel* *; who elsewhere †
 also writes as follows: “ Husbandmen to this very
 “ time, as the most learned *Guillandinus* relates,
 “ in *Arabia*, *Agypt*, *Mesopotamia*, *Judæa*, *Phœnicia*,
 “ and all *Syria*, being desirous to prevent the fe-
 “ males degenerating either into a state of barren-
 “ ness, or losing their fruit before maturity, they
 “ so plant in rows the palm-trees of both sexes,
 “ as the males are only at least so far distant from
 “ the females, that the powder, taken away, by
 “ blasts of winds, from the leaves of the males,
 “ may fall on the leaves of the females; and that
 “ is found sufficient to fecundate and ripen the
 “ fruit. But, it is wonderful to be related, if any
 “ female stand at a great distance from a male, so
 “ that neither the powder, nor breath or smell of
 “ this can make its way to it, the planters have
 “ contrived to stretch a rope from the male to the
 “ female, each extremity of which is tied to each
 “ tree; and thus as it were the female, being
 “ coupled with a bond of wedlock, by the in-
 “ fluence of the male creeping secretly along the
 “ cord,

* *Theophrasti Eresii de Historia plantarum libri*
decem (novem potius), quos illustravit Joannes
Bodæus à Stapel. Amstelodami 1644. in folio
Vid. p. 115.

† p. 103.

“ cord, is made fruitful, which before became
 “ barren in that solitude.” It is indeed evident,
 that insects may creep along a cord; but, who ever
 saw a powder creeping in the same manner?

46. Besides, the necessity, yea and even the
 truth of such a culture of palm-trees themselves,
 are deservedly doubted of. “ When in the south
 “ part of *Spain* where the river *Bætis* runs, named
 “ *Andalusia*, which abounds with palm-trees, I
 “ inquired of some very sensible men concerning
 “ this matter, I could get no certain intelligence.
 “ I can however speak of the Hops with more cer-
 “ tainty. In the royal garden at *Paris* it grows
 “ luxuriantly and is every year burthened with
 “ fruit. But that which bears flowers, is not to be
 “ found, except in the islands of the rivers *Seine*
 “ and *Marne*, which are at a great distance; yet
 “ in the royal garden it produces seeds. *” Mr.
Wahlbom’s answer with regard to the Hops is this †.
 “ The Hops (*which he calls Humulus*) is certainly
 “ of two kinds; the one is proud with stamifer-
 “ ous, and the other with pistilliferous flowers;
 “ and that which they commonly call the fruit, is
 “ only the explicated and elongated *calyx*: hence
 “ although there is a female Hops, and it be not
 “ fecundated, yet it can bring forth cones. See
 “ the *Iter Gottland*. 275. This deceived *Tourne-*
 “ fort, so that he would not acknowledge the sexes
 “ of plants, since the hops (female) grew luxu-
 “ riantly in the garden at *Paris*, loaded every
 “ year with fruit, but what bore flowers (the
 H 2 “ male)

* *Inst.* p. 39.

† *Amen. acad.* p. 99.

“ male) did not occur unless in the islands of the
 “ *Marne* and *Seine* at a considerable distance, p. 69.
 “ The same thing happens in the Mulberry Tree
 “ and the Blite, whose berries are the succulent
 “ calyces, and by no means pericarpia or ovaria,”
 (or proper receptacles of the seed). In this
 manner the author of the *Sponsalia* trifles again.
 Wherein, I pray, is *Tournefort* deceived? He dis-
 tinctly gives the characteristic, and accurately
 paints the flowers and fruit*; so that without the
 the benefit of *Tournefort*'s table of the *Lupulus*, the
 character of the *Humulus* in *Linnaeus*'s *Genera*
Plantarum † is not easily understood. At least
 Mr. *Wahlbom* does not well understand him. For,
 he seems to blame *Tournefort*, because he calls the
 fruit cones; though “ what they commonly call the
 “ fruit, is only the calyx explicated and elongat-
 “ ed.” But it is really the fruit according to
Linnaeus himself; for, “ the essence of a fruit con-
 “ sists in the seed. ‡” And “ the fruit is known
 “ by itself from the seed, whether it be covered
 “ with the pericarpium (fruit or seed-vessel), or
 “ not || .” Yea, it is proud with pistilliferous
 flowers, according to Mr. *Wahlbom*: therefore these
 cones, or elongated calyces, are really the fruit.
 But, whether it be the fruit, or be not the fruit,
 is of no consequence, since *Tournefort* adds in ex-
 press words, “ in the royal garden it brings forth
 “ seed.” The *Sponsalia* omit these things, though
 the question is only concerning the seed. What

* p. 535. tab. 309:

† p. 477.

‡ *Phil. Bot.* § 88.

|| *Ibid.* p. 56.

is to be seen in the *Iter Gottland*. I know not; but the hops sold here are full of seeds; although the *Humulus* which is proud with pistilliferous flowers is only cultivated. As to the Mulberry Tree and the Blite, they have almost nothing common with the Hops. Yea, in the Blite "the Pericarpium" is a very small capsula (or bag), and the crust "of the seed is commonly oval, and a little flat," according to *Linnaeus* *. But to return to the palm-tree.

§ XIV.

47. What accounts are handed down to us concerning the culture of palm-trees, do not agree well amongst themselves, as will easily appear to any one who will compare the cited authors. *John Baubine* says that he saw, at *Montpelier*, an extraordinary palm-tree flowering in the spring, and also bearing sufficiently large dates in the autumn. "I have likewise, he says, both flowers" and dates gathered from the tree. It is believed to be above an hundred years old; and "it is a common perswasion there, that it does not" bear fruit till it has arrived at a great age, and "scarce before the fiftieth year, as some reported.†" This late commencing fructification of palm-trees seems to have given rise to some fables; such as that of *Jovianus Pontanus*, who in a poem celebrates

* *Gen. pl.* p. 5.

† *Historia plantarum universalis, auctoribus Johanne Baubino, & Joh. Henr. Cherlero. in 3 Voll. Ebroduni 1650. & 1651. in folio. Vid. Vol. I. p. 360.*

celebrates two palm-trees, the one a male at *Brundisium*, the other a female at *Otranto*, which continued long barren, while, to wit, by little and little they were springing up, and the one could not yet look stedfastly at the other: but, when they were grown up so tall that they could see one another, though at the distance of no less than many furlongs, they began to bear fruit *. It seems also to have occasioned those other stories concerning the amours of palm-trees, in *Pliny*, and which we have more at large in the *Geoponics* of the *Florentine* (*Virgil*). "Howbeit, (says *Pliny*, "treating of palm-trees †), they ascertain the fact, "that the females do not procreate without the "males, yet the woods produce them naturally: "and that many of them incline round a single "male, complimenting it with their branches and "leaves bended forwards. That this having "erected its shaggy leaves, by its breath, and "sight itself, and also by its dust, marries them " (or is married by them). If this tree be cut "down, the female widows afterwards become "barren. And therefore there is a venereal intention, like moreover the coition which is invented by men, from the males sprinkling upon the females their flower and down, but in reality "only their powder." Thus *Pliny*. *Cassianus Bassus*, l. 10. c. 4. relates these things more elegantly in this manner: "But yet the palm-tree "itself loves, and indeed ardently, another palm-tree, as the *Florentine* in his *Georgics* acquaints us; "nor does its first desire cease, till its beloved "comforts

* *Ibid.* p. 363. vel *Bod. in Theoph.* p. 103.

† *Hist. nat.* l. 13. c. 4. p. 320.

“ comforts it. For, one may see the tree itself
 “ bended, and neither satisfied with the ground
 “ it stands on, nor producing fruit. And this very
 “ thing is known to the husbandman: for, he
 “ knows that it loves, but he is ignorant of what
 “ it loves, &c.” Whoever delights in these idle
 tales may read *John Bauhine* *, or *Bodæus à Stapel*
 on *Theophrastus* †. Because, by these two authors,
 most things, if not all, that are taught concerning
 the fecundation of palm-trees, are delivered. Yea,
 it seems to be very certain, that a solitary date-
 bearing palm-tree hath produced ripe dates; but
 whether the stones of such dates are fertile, I dare
 not yet determine. Howsoever, whether they are
 fruitful, or unfruitful, it is of little signification to-
 wards establishing the general doctrine, since it
 is a single example, as *Theophrastus* ‡ informs us,
 especially as many things evince the contrary.

48. 3dly, Another class of arguments is bor-
 rowed from a comparison of vegetables with ani-
 mals ||. But analogy alone proves nothing. It is
 a vulgar saying, that every thing which is like
 another is also unlike it. They accord in many
 things; but it does not thence follow, that they
 agree in all. “ In short, (says *Theophrastus* |||), all
 “ things ought not to be admitted as alike even
 “ in animals. For, there is every where a power
 “ of growing, because even on every side there is
 “ something

* *Vol. 1. p. 362. & seq.*

† *p. 103.*

‡ *Wd. No. 44. supra.*

|| *Vid. Fund. Bot. § 132. ad. 150.*

||| *De hist. pl. l. 1. c. 1.*

“ something endued with life.” And *Malpighius* * observes, “ In vegetables, where there is not so great an apparatus of organs, and in every sensible particle of them there are all things which are found in the whole, *without any interposed generation*, whatsoever branches are cut off them grow up into new buds or shoots; even by the assistance of nature, the very small and com- pendious little plants which fall off tender twigs, under the form of seeds, perpetuate propagation every year.” Hence plants are often more successfully and more easily propagated by gems, than by seeds: hence *Garlick, Onions, Leeks, &c.* bear gems in the place of roots, and likewise on the tops of their stalks, instead of seed: and hence likewise the seed of the *Sow-bread*, as *Clusius* † takes notice, committed to the ground, is not changed into a germ, but converted into a tubercle or little root, contrary to the nature of other seeds, from which it afterwards brings out leaves. Such like young shoots or buds *Casalpinus* saw on the tops of the leaves of the herb named *Moly*; they frequently occur on the stems of *Tulips*; and the bulb-bearing *Lilies* are known to every one. But what is a gem?

49. “ A young shoot, or bud, differs from a seed, as a living foetus from its ovum. For, a seed is as it were an egg, in which there is a vital principle, but nothing of life: but a gem lives, at first indeed by its parent, as its germ, “ but

* *Anat. pl. p. 76.*

† *Caroli Clusii, rariorum plantarum Historia. Antverpiæ 1601. in folio. Vid. p. 264.*

"but afterwards by itself, and draws moisture
 "from the earth by its own roots," *Casalpinus* *.
 "Gems are as it were the infant, or foetus so fe-
 "cured, that being increased in its own time, and
 "growing up into a young branch, it at last pro-
 "duces seeds. A seed therefore probably is as it
 "were a pendulous gem, and which falls off its
 "parent, it being about to germinate in another
 "piece of soil," *Malpighius* †. And in a learned
 treatise, intitled *Gemmae Arborum*, à *Petro Lofling*
Madelpado, it is thus described, "A gem is a part
 "of a plant seated upon the root, which covers
 "with scales, that are the rudiments of leaves,
 "the embryo of the future herb ‡." And else-
 where ||, "I therefore conceive a gem to be like
 "an herb reduced into a compend, covered, and
 "contracted with its outmost leaves, that it may
 "be preserved from the injury of the air; which
 "herb wants nothing farther, but a power of ex-
 "tending itself; and this heat at last excites."
 A gem therefore is a little plant, or embryo of a
 plant, with its proper involucre or coverings.
 "That vegetables, (says *Linneus*) come forth
 "from an egg, reason and experience often de-
 "clare; and that the seeds of vegetables are their
 "ova, the end they answer informs us; which is,
 "to produce buds or young shoots exactly like
 "their parents. That generations of plants from
 "a seed and gem are coeval, the inspection of
 "gems and the wantonness of blossoms teach.

(* *L. R. c. 5.*

† *Anat. pl. p. 39. & 77.*

‡ *Aman. acad. vol. 2. p. 185.*

|| *p. 192.*

"The seed properly, is the new rudiment of a vegetable, moistened with an humour, and coated with a bladder *." Therefore a seed is a gem, or a young shoot or bud that falls down, or the embryo of the plant, or a little plant with its coverings. Consequently a gem may be properly enough and truly called another seed, or a more perfect seed. But Mr. *Lofting* † says, "Those that represent a gem to themselves as another feed, deceive and are deceived;" how truly, let others judge.

50. If, therefore, gems are as it were more perfect seeds, and come forth plentifully out of most plants, especially when lopped, or pruned, yea, out of the smoothest parts of the bark; and if a very small part of a plant often grows up into a new shoot, or puts forth gems, without any distinction of sexes or blossom; what, I pray, analogically forbids us to conclude, that seeds, those more imperfect gems, are produced, without the falling down of the powder of the antheræ upon the stigmata, or any intervening generation?

§ XV.

51. But, according to *Linneus*, the sight often declares the contrary. What does our sight often tell us? Famous authors give a threefold answer to this query. "Autopsy itself (says *Job. Gesnerus*),

* *Vid. Phil. Bot. p. 88. 89. & 54.*

† *Aman. acad. 9. p. 185.*

“ *Gesnerus* *), certifies this Act of generation.
 “ The first person that saw the marriages of
 “ flowers, was the celebrated Mr. *Sebastian Vaill-*
 “ *lant*, who in a particular little treatise on the
 “ structure of flowers, describes them so elegant-
 “ ly, that no body can have any doubt left about
 “ this matter; notwithstanding the different sen-
 “ timents of the famous *Pontedera* and *Siegesbeck*,
 “ who, in broad day-light, do not acknowledge
 “ the sexes and generative act of plants. But the fa-
 “ mous *Vaillant* talks in this manner: How often has
 “ it happened, that one and the same plant bears
 “ at one and the same time flowers, some of which
 “ are only female, but others are male and female
 “ conjoined (*or hermaphroditical*), that these sur-
 “ round the organs (*he means those of generation*),
 “ and an erection and swelling of the male organs
 “ happen in them so suddenly, that the lappets
 “ of the flowering gem give way to or retire by
 “ the force or impetus, and here and there expand
 “ themselves with a truly wonderful velocity; nor
 “ do they sooner find themselves at liberty and pre-
 “ pared, but that they immediately and as violently
 “ as possible explode and throw out (*of the apices,*
 “ *to wit*) at one impetus or effort all their impreg-
 “ nating generating feed (*genitura*), to wit, by
 “ diffusing a little cloud of dust, which spreads

I 2

“ every

* *Johannis Gesneri Dissertationes Physicæ de Ver-*
getabilibus, in quibus Elementa Botanica celeb. Lin-
naei dilucide explicantur; conjunctim cum C. Linnaei
oratione de necessitate peregrinationum intra Pa-
triam. Lugd. Bat. 1743. in 8vo. Vid. Dissert. p. 89:

“ every way the fecundation of the before unim-
 “ pregnated female genital organ (*arvigentalis*)?
 “ This venereal interlude is scarce ended, before
 “ the lips or lappets of the flowers immediately
 “ come near together, and indeed with the same
 “ violence of celerity or impetuosity by which
 “ they had receded from one another, and so in-
 “ stantly regain their pristine form. Any one
 “ may easily see this artful apparatus in the *Pa-*
 “ *rietaria* (or *Pellitory of the wall*). But he must
 “ approach it at the hour devoted to venerary ! It
 “ is the morning that favours these rencounters ;
 “ but when they refuse to perform them at a suf-
 “ ficiently seasonable time, you may even force
 “ them thereto, if you do but stimulate, or prick
 “ them gently, with the point of a small needle.
 “ In hermaphrodites, where the two sexes are
 “ joined together, there is very far from being so
 “ great and impetuous an explosion : for, most
 “ flowers, especially the nodding, or such as hang
 “ down their heads, in which the pistillum is
 “ placed obliquely within the stamina, exercise
 “ the act of generation with their flowers shut,
 “ while the stigma (or superior extremity of the
 “ pistillum) is contained within the middle of the
 “ antheræ (or apices).” Thus far Mr. Gesner.

52. But, with deference to Gesner, John Baubine,
 who died above fifty years before Vaillant was
 born, hath described in a few words this artful
 apparatus in the *Parietaria*, without any silly
 poetical flourishes. “ The little flowers of the
 “ *parietaria*, which are crowded about the stalk,
 “ and grow out of the lower extremities of the
 “ stems

“ stems of the leaves, resemble locks of scarlet
 “ silk, immediately after they start out of the
 “ little knot of the stem: after them the stamina
 “ appear obscurely, wrapt up among the purpleish
 “ white little apices; which if you endeavour to
 “ unfold with a pin, the powder is cast out by
 “ jumps with force, when it is pleasant to behold,
 “ that the floscules are bent backward and expand
 “ themselves, so as to surround the rudiment of
 “ the seed which is in the middle.” Thus *John*
Baubine, vol. 2. p. 976. And the same may be
 read by any one in *Morison* *, and *Ray* †; though
Vaillant delivers it as properly his own observa-
 tion.

“ In the *parietaria* two hermaphroditical flowers
 “ are contained in a plane covering consisting of
 “ six leaves, and one female flower, betwixt the
 “ two hermaphroditical flowers, and within the
 “ same covering.” *Lin. Gen. pl.* p. 494. Hence
 this violent and sudden explosion seems rather to
 certify, that this powder of the apices is entirely
 useless to the germina (or top of the pestil), if not
 hurtful. For, the stamina inclosed with the ger-
 mina in a common envelopment, do not cast out
 their dust, before that by erecting themselves,
 they here and there expand the lappets of the
 gem, or leaves of the envelopment; and they no
 sooner find themselves at liberty, and high enough
 raised in the air above the involucre, but that
 they

* *Plantarum Historia universalis Oxoniensis*,
 auctore Roberto Morison. pars 2. Oxonii 1680.
 Pars 3. *ibid.* 1699. in folio. Vid. 2. p. 600.

† *Hist. pl.* p. 206.

they immediately explode and throw out most violently, and at one effort or impetus, all their powder: and as if there was fear, lest any particle of this noxious dust should fall down upon the stigmata of the pestils, which are much shorter than the stamina; and when the explosion is finished, the lips or lappers of the flowers, that is, the leaves of their covering, instantly come near together, with indeed the same impetuosity by which they retired from each other, and immediately restore themselves to their former situation. "In such a manner indeed, (adds *Vaillant* *), that it would be very difficult to believe, that these flowers have suffered any violence, unless even the eye itself had seen this act, or should yet see the decaying skeletons of magnanimous heroes, for a little while erected on a field of battle, where, like banners, they sustain the conflicts and jocular sportings of the flying west wind." What is clearer than this? Of what sort is this autopsy?

§3. But Mr. *Wahlbom* seems to have been of a different opinion; at least he differently explains these words, *the sight often tells or confirms*: for he says, "That these things are thus performed in plants, *the sight* in the first place frequently informs us. It is at first sight obvious, that while a flower is in blossom, and the powder of the antheræ flying about, this powder does stick to the stigma.†" Yet it is not at all obvious that generation is thus performed. Nor from

* *De fruct. fl.* p. 9.

† *Aman. Acad.* p. 90.

from the floescence of the *Viola tricolor*, B. P. the *Gratiola*, *Iris*, *Campanula*, and *Syngenesious* plants tyed down to it; or from any of these observations, howsoever obscenely, related: while the position of the antheræ, in the *Iris* and *Campanula*, manifestly shew to the eyes, that the falling down of the powder upon the stigmata is impossible. But let us hear the most famous *Linnaeus* himself.

54. "That the generation of vegetables is thus brought about, the *sight* confirms: That the dust enters the germina, *Morland* believed; that its essence is extracted by means of the moist stigma, *Vaillant* determines; that the powder of the Maple is broken in the humour, B. *Jussieu* saw; and that all the powder explodes in the humour & seminal aura, or breath, *Needham* confirms." Thus the Phil. Bot. p. 91. *Vaillant* redargues most manifestly the opinion of *Morland*; who determines that the volatile spirit, or vapour, or breath of the powder, enters the tracheæ of the tubæ (or pistilla) by their extremities; but I do not find in him one word of extracting the essence of the powder, or moisture of the stigma. And if all the powder be broken in the humour, how is thence follows that they explode in such a manner a seminal aura, I do not see; especially since it by no means appears, that the stigmata ought to be wet with an humour in order to fertility; and "in almost all flowers it is seen, how they expand themselves in the scorching sun; but in the evening and in a moist air, they fold together their floscules, lest water should come to and coagulate the powder, by which means it could not

" not be blown to the stigmata. * " The *figh* therefore seems to tell nothing often, nor confirm any thing concerning the generation of plants tyed down to it.

55. If these most famous sexualists had observed the florescence of the *Urtica urens maxima* B. P. they might have thence deduced a more solid argument to establish the opinion of *Vaillant*, than from the *Parietaria*. For, no one can look on this barren herb, in a dry summer, for scarce one or two minutes of time, without seeing frequent and sudden explosions of the powder of the apices. But this is a single example ; nor are we hitherto surpris'd with any such thing in the *Mercurialis*, *Spinacia*, *Cannabis*, or any other barren plant. "

56. That the generation of vegetables happens in the before-mentioned manner, *proportion* confirms †. " From proportion too, (says *Gesner* ‡), " we judge it to be very likely, since according " to the size and number of the seeds, the stamina " themselves are likewise larger, or more nume- " rous. " But he is quite mistaken, as by comparing the *Monandria* with the *Polyandria* of *Linnaeus* will easily appear. " *Proportion* in the " second place frequently declares the same thing. " For most part the stamina and pistilla are of an " equal height, that by this means the powder, " with the help of the wind, may come to the " stigma the better ; but in some plants they are

* *Aman. Acad.* p. 93. " not
† *Phil. Bot.* p. 91. " their
‡ *Diff.* p. 90. " coarsen the powder "

“not equally high, where a singular process of
“fœcundation is observed.” Thus the Spons.
plant *. For most part, truly it often declares
nothing, especially since in many plants it occurs
otherwise; as in the Crocus, Iris, Phalangium,
Lily, and most of this class, not to mention others,
where no singular process of fœcundation is ob-
served: yea, of the six plants mentioned by the
author, in which such a process is said to obtain,
three of them, viz. the Dianthus, Nigella, and
Paffiflora, have their pistilla raised high above
the stamina, nor do they touch them when bend-
ed, the stigmata being constantly elevated above
them; while in the mean time the antheræ open
on their lowest side, the powder is only dropt or
falls down; as if the stigmata were as much as
possible to be shunned, lest they be hurt by the
odious powder.

The argument from proportion Mr. *Linnaeus* thus illustrates. "Proportion: That the stigmata bend themselves to the antheræ, and are then stretched out, appears from the *Dianthus*, *Passiflora*, and *Nigella*. When the pistillum is very short, the antheræ open and close above the stigmata; as in the *Saxifraga* and *Parnassia*. The antheræ open and close while they blow out the powder in the *Celofia*. The corolla presses with its fingers the antheræ to the stigmata in the *Tenacrium*." Phil. Bot. p. 91. But what then? Here is nothing said of the proportion often telling or confirming that generation is accomplished in the assigned manner. Here causes of inequality are assigned, but no instance is given of proportion.

* Amen. Acad. p. 90.

tion. It is therefore of little moment, whether these things are so, or not. What things are written concerning place, time, showers, nodding flowers, &c. it is easy to confute by examples; but what has been said may suffice.

§ XVI.

57. Various other arguments, against the doctrine of the sexes, are to be taken from the less perfect plants; subterraneous and submarine fructification; the structure of flowers; even their right inspection, &c. Who ever saw the antheræ and stigmata in all the species of the sixteenth and seventeenth classes of *Tournefort's* Institutions, or of the *Cryptogamiæ* of *Linnaeus*? Who will believe, "That all kinds of vegetables are furnished with a flower and fruit, even where the sight has not discovered them*? It seems credible enough." But, to avoid prolixity, I forbear to add any thing more concerning these matters. Yet I cannot pass by one or two propositions, in some measure appertaining to them, and which are singular enough.

58. As (1), "In the beginning of things, we contend that one pair of sexes of every sort of vegetables and animals was created," *Phil. Bot.* p. 86 †. And our author's oration *Concerning the increase of the habitable earth* ‡ explains this opinion, the reasons being there given, which per-
fwaded

* *Fund. Bot.* § 139.

† Reason advises it, *Fund. Bot.* § 132.

‡ *Aman. acad.* 2. p. 439.

swaded him to believe it. It is indeed a new doctrine, but only speculative. Yet, we are not rashly to assent to it, unless it be before-hand shewn, how one pair of sexes of vegetables, could be sufficient to supply with food all the pairs of animals in paradise; and where they afterwards found aliment, when *Adam* was banished out of *Eden*, and the ground was cursed on account of his transgression.

59. (2), "*Harvey* did not without reason assert that life consists in the circulation of the blood. I agree to his opinion, and define *life* to be a spontaneous propulsion of humours. Where there is a spontaneous propulsion of humours, it thence appears that there there is life: in vegetables and plants there is a propulsion of humours: Therefore every one must see that vegetables and plants live." Spons. plant. * Here he argues logically: but if there is here no typographical error, this is a sophism, consisting of four terms; for, *propulsion*, and *spontaneous* propulsion are very different. However, though it be granted that life supposes a spontaneous propulsion, yet, it does not thence follow, that such a propulsion is life, since it is only the effect of life. Moreover, it does not appear that the humours of vegetables are always propelled, or are always in motion, much less that they are spontaneously propelled, since their motion is necessary, and depends intirely on external causes, "*and also that they are not found to have any voluntary motion.*" Phil. Bot. P. 93.

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60.

* *Aman. Acad.* p. 64. & 65.

60. (3), "I would have it likewise be attended to, that the *Calyx* arises from the exterior bark of the plant; the *Corolla* from the interior bark; the *Stamina* from the nourishing alburnum (or that part of the wood of a tree immediately under the inner bark, called the sap, which is commonly white); the *Pericarpium* (or receptacle of the seed) from the woody substance; the *Seeds* from the pith of the tree; for, they are placed in this order, and also opened in this order." Spons. plant.* "A vegetable consists of *Pith*, clothed with *Wood*, which is separated from the *Bark*, and covered with a *Cuticle* (*Epidermide*)." Phil. Bot.† Thus trees only are to be called vegetables. For, as far as *Malpighius*, *Grew*, *Ray*, &c. could discern, trees alone were provided with a bark, an inner bark, and the alburnum or sappy part. But, "we do not doubt, but that in a future time these parts will be very differently expounded ‡." It is useless to inquire what may happen in futurity; but, at this day, the *stamina* arise sometimes from the stigma ||, often from the germen, very often from the corolla; the *pericarpium* from the calyx, or commonly from the pistillum, &c. Any one, that will, may attend to these things.

61. (4), "The antients were absolutely persuaded, that the juice of vegetables which ascends from the root into the trunk, again descends:

* *Amen. Acad.* 1. 104.

† p. 37. *Vid. etiam* p. 52. & *Fund. Bot.* § 86.

‡ *Spons. pl. Amen. Acad.* 1. p. 70.

|| *Vid. No. 37. supra.*

“ ascends : but the most famous natural philosopher
 “ *Hales* of the present age, has made a strong ob-
 “ jection to this opinion, he having demonstrated
 “ that this humour which is carried from the root
 “ by the trunk into the small branches, by no
 “ means *does return*, but is evaporated by the
 “ perspiration of the leaves.” Spons. plant. *
 But he does not seem to understand the celebrated
Hales : for, he admits, that the sap in some de-
 gree does return from the tops of plants, towards
 their inferior parts ; because he relates experi-
 ments which clearly shew it † : to which, if the
 observations concerning the weeping of the vine,
 &c. be added, they make some sort of a circula-
 tion as it were very probable.

I have likewise seen a young branch, growing
 out of a vine in the open air, brought through a
 hole into a stove, in the middle of March, full of
 vigorous young shoots, yea, loaded with bunches
 of flowers, which before the end of June as I
 heard, ripened the fruit ; that is, three months
 before the usual time of vines, growing in the
 most Sunny part of the garden. The most famous
Linnaeus himself says, “ Plants have no heart, but
 “ heat effects every thing in them ; nor do they
 “ need an heart, where neither the effect of a
 “ perpetual motion is necessary, and where there
 “ is a propulsion, and not a circulation of hu-
 “ mours. ‡” But how heating a single branch,
 while the root remains in the cold earth, is able

* *Amen. Acad.* p. 65.

† See his *Statics*, vol. I. c. 4. from p. 128. to
 155. and especially fig. 22. 24. 25. 27. 28. & 29.

‡ *Phil. Bot.* p. 88. & 91.

to hasten its fructification in such a manner, without a circulation, I cannot conceive.

62. Concerning the use of the stamina there are various conjectures. " Those flowers, (says "*Pontedera* *), which are only furnished with a " calyx and stamina supporting the apices, I am " of opinion are not to be reckoned flowers, since " fruitful flowers always want them: Yet, they " are necessary, and extremely useful, to the " flowers in which they are found, though they " are situated at a great distance from the fruit ; " as in the Amentaceous plants (or such as produce catkins), the Mays, *Lacryma Job*, *Ricinus*, " *Typha*, and *Sparganium* ; because a resinous " and volatile juice is conveyed to the fruit by " the footstalk of the amentum, or catkin. But " in barren plants, I very willingly confess I am " ignorant of their use." But the flowers which only consist of a calyx and stamina in barren plants, have certainly an equal right to be reckoned flowers, as such like in fruitful plants. [See above the sentiments of *Cæsalpinus* and *Ray*, No. 40]. Perhaps, from the above-mentioned observations concerning the powder of the *Parietaria*, it may be concluded, that this powder is quite useless to the parent ; perhaps that it is noxious, and therefore in some measure may contribute to the variety of flowers, the production of fruits, &c. which are pretty often morbid varieties. Perhaps it may be produced for the sake of insects : for, of what service the powder is to the plant, * for instance, of the barren Hemp, to the fruit-bearing Hemp,

Hemp, does not appear, nor perhaps will it ever appear.

§ XVII.

63. It would not be worth while to argue against the sexes of plants, unless it had given occasion to the specious contrivance of a System, or Method of plants, named sexual, which of all others, how many soever there are, is the most intricate, and involved, and unnatural. Because there is no system, whether it be orthodox, or heterodox, in which more dissimilar things are conjoined, and more similar separated; and the knowledge of which, by reason of an introduced dialect unknown to the Greeks as well as to the Latins, also by reason of the loosely changed familiar ideas of words and names, is acquired with greater difficulty. Yea, by the assistance of *Tournefort's* Institutions, and a garden well stock'd with plants digested in his method, a Learner will acquire a knowledge of them much sooner and more easily, (even without a master), than understand the *Linnean* nomenclature, but tolerably, though assisted by the explications of the famous *Gesner*, the *Sponsalia Plantarum*, and *Philosophia Botanica*, &c. : while according to the sexual system, where trees are confounded with herbs, a methodical *Syntax* or Construction of Plants in a garden is impossible. For, although it is of little signification what kinds follow immediately one another in a written system, yet, in a living one, or nursery of plants, it is far otherwise, since as shades are hurtful to corn, so they are injurious to almost all herbs.

" The

“ The things necessary to make a Botanist
 “ (says the celebrated *Linnaeus* *, are, [a] A li-
 “ brary very valuable on account of its copper-
 “ plates. [b] Almost all the books, that were
 “ ever published. [c] A garden very well fur-
 “ nished with living plants, with their various
 “ winter-quarters and stoves. [d] A literary
 “ correspondence almost through the whole world.
 “ [e] Journeys into various remote countries.
 “ [f] A sumptuous education in painting, study-
 “ ing, reading, and consulting; yet all these,
 “ unless he is born a Botanist, or is endowed with
 “ a most acute genius, never constitute a happy
 “ Botanist.” Therefore a happy Botanist will be
 a rare bird in the earth; but it will be miserable
 happiness! For, it is added, “ When any one at
 “ last is a Botanist, he thence derives no gain, no
 “ recompence: and few offices occur which call
 “ him to their performance.” If therefore so
 little, or no advantage, arises from so great labours,
 who in his senses will cultivate Botany in this
 manner, or affect to be a happy Botanist?

64. However, Botany is a tedious and difficult
 science without a method. Therefore, whatsoever
 system, whether it be natural, or artificial, which
 neither facilitates, nor shortens it, is evidently of
 no use; nay, if it introduces various new names,
 without necessity, or terms of art unheard of be-
 fore, it is altogether hurtful. For, thus, (as the
 great *Boerhaave* speaks†), the heavy study of the art,
 is

* *C. Linnæi Critica Botanica. Lugd. Bat. 1737.*
 in 8vo. Vid. p. 73.

† *Iud. pref. p. 15.*

is aggravated by a new study, and puzzling trifles occasion Botany to appear both foolish and difficult.

The illustrious author of *the sexual system* would never have fallen into such mistakes, if he had not been prematurely prepossessed in his youth with this plausible theory of generation. "The singular structure, *he says*, and remarkable office, of the stamina and pistilla, enticed my mind, to inquire what nature had concealed in them. They commended themselves by the function which they perform, since on these alone the propagation of plants wholly depends. For, *a flower is nothing but an act of the generation of plants.**" Truly a singular definition of a flower! Sometimes it is called genital organs, and sometimes an act of generation; most philosophically.

65. I contend that the generical names, in the sexual system, are very often changed without any necessity; and that the rules which the author has prescribed to himself in the *Fundamenta Botanica*, are quite arbitrary, for most part useless, and frequently deceitful.

For, 1st, He applies the ancient names, which he calls *vague*, oftner by far to divers plants, than they have denoted in every age. Thus, for example, [a] *Glechoma*, which he has among the

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antiently

* *C. Linnæi Classēs plantarum, seu Systemata Plantarum omnia à fructificatione desumpta, quorum xvi. universalis, et xiii. partialis. Lugd. Bat. 1738. in 8vo. Vid. p. 441.*

antiently received names *, for *Glechon*, I suppose (for, I do not find *Glechoma* among the antients), which Greek name of the Penny-royal used by *Hippocrates* himself, he makes the generical name of the *Hedera terrestris, vulgaris*, B. P. notwithstanding there are other worthy enough synonymous appellations, viz. the *Chamæcissus* & *Chamæclema* †. [b] *Bubon*, is likewise among the antiently received names ‡: Yet, among the antients, it does not signify a plant, but the groin, or a tumour ||. He therefore should have called it *Bubonium*; and this usually means Inguinal; but with the celebrated *Linnaeus*, the *Petroselinum Macedonicum* Dod. is a kind of *Bubon*. [c] What *Gomphrena* signifies, I know not, nor is it to be found in the Greeks or Latins, though it is numbered with the antiently used denominations |||. Perhaps he means *Gomphena*, which, with *Pliny*, signifies a Species of the *Amarantus*, not the *Amaranthoides* of the moderns. In a word, the *Andrachne*, *Anthericum*, *Aizoon*, *Atræylis*, *Comarum*, *Bunias*, *Elatine*, *Erigerum*, *Melia*, *Hibiscus*, *Trichomanes*, *Asplenium*, *Myrica*, *Melampodium*, *Psidium*, *Peganum*, *Carica*, and hundreds of others ††, are ill applied, or wrested into a contrary sense. From such a confusion of names, it is easy to foresee how many errors may take their rise

* *Crit. Bot.* p. 121.

† *Vid. Fund. Bot.* § 244.

‡ *Crit. Bot.* p. 121.

|| *Vid. Fund. Bot.* § 231.

||| *Crit. Bot.* p. 121.

†† *Vid. Crit. Bot.* p. 119. ad 123.

rife in the study of Botany and Languages; yea, in Medicine itself.

66. But yet, 2^{dly}, He rejects the names most frequently used, for no other reason, but because they are neither of Greek nor Latin original; * foolishly enough: since both Greek and Latin names are often borrowed from foreigners, or Barbarians; such as, the *Anomum*, *Piper*, *Macis*, *Zingiber*, *Pistacia*, *Cassia*, *Costus*, *Balsamum*, *Isatis*, *Nardus*, and a great many more: nor indeed is it of any moment, whether they are of a *Lapland*, *Chinese*, or *American* original, if so be they are not very difficultly pronounced, nor offensive to delicate ears. Therefore, the *Adhatoda*, *Acajou*, *Alhagi*, *Alkekengi*, *Azedarach*, &c. are rejected without cause as proper to particular countries, or at other times those used by *Tournefort*; the *Menyanthe*, *Jalapa*, *Ephemerum*, *Xiphium*, and *Thuya*, perhaps being excepted, which are badly applied. "For the nature of etymology seems to be of little importance in this subject; since it is certain, that those who first gave names to plants, had no regard to the genus itself, but only to one species, which its distinguishing marks procured it.†"

67. 3^{dly}, The most famous author condemns the very long, and likewise the *Induseous* names ‡. "I call those very long names, which include

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" more

* *Fund. Bot.* § 229.

† *T. Inst.* p. 61.

‡ *Fund. Bot.* § 249.

“ more than twelve letters * ;” as the *Anapodophyllum*, *Staphylo-dendron*, *Bulbo-castanum*, *Chamar-bodendros*, and *Amaranthoides* ; though they shew better the facies or habitus of the plants, or of some part of them, than *Podophyllon*, *Staphylæa*, *Bunium*, *Azalea*, and *Gomphrena* † ; and he retains *Ceratophyllum*, *Chrysosplenium*, *Dracoccephalum*, *Mesembryanthemum*, *Taberna-montana*, *Tetragonotheca*, and *Trichosanthes*.

“ I call those *nauseous* or *nauseating* appellations, he says, which keep no similitude to the rest in botanical books, but are quite different from, or foreign to them, and to me seem as it were to be barbarous. *Ballote*, *Leontopetalon*, and *Siliquastrum*, are nauseous. ‡” He does not here act the part of a Critic in the common way. Greek and Latin appellations seem as it were barbarous to him ; and instead of *Ballote* and *Leontopetalon*, which occur in *Dioscorides* and *Pliny*, he writes *Ballota* and *Leontice* ; and *Siliquastrum* the Plinian name, he changes into *Cercis* ; while the *Leontice* is the *Cacalia*, and the *Cercis* a species of the *Poplar*. He certainly with a better excuse might have called the *Clitoria*, *Cynomorium*, *Lycoperdon*, *Onopordum*, &c. *nauseous*. [See what he writes concerning taking the similitude of the specific name, in *Phil. Bot.* p. 234].

68. 4thly, “ The generical names made up of two whole and distinct words, should be expell’d

* *Crit. Bot.* p. 134.

† *Vid. Fund. Bot.* § 240.

‡ *Crit. Bot.* p. 134.

"pelled out of the Republic of Botany," Fund. Bot. § 221*. Therefore *Rosmarinus*, *Astaphisagria*, *Centaurium majus et minus*, *Jovis Barba*, *Fœnum græcum*, *Sempervivum*, and the like, must be banished. However, from favour, he says †, "We have admitted some Latin names, yet they are not for this reason to be henceforth imitated; as *Cornucopia*, *Rosmarinus*, *Sempervivum*, and *Sanguisorba*." But he passes an irreverſible ſentence againſt the *Bella donna* T. (it is written by *Tournefort* *Belladonna* in one word), *Centaurium majus*, *Dens Leonis*, &c. ‡. He gives this reaſon for it ||, "The number of generical names is already large enough, and indeed ſufficient for any weak memory to retain, ſo that it is needleſs to multiply exiſtences without any neceſſity. What need, I pray, is there of two words, when one is ſufficient? Good ſenſe owns, that it is fooliſh to do that by many things, which can be done as well by fewer; and here therefore we ought to follow this dictate. The latter word is with equal difficulty inſcribed on the table of the memory as the former; *Donna*, as *Bella*; *Idea*, as *Vitis*, &c." Where *Belladonna*, *Burſapaſtoris*, *Centaurium minus*, *Dens Leonis*, *Fœnu-græcum*, *Lilium convallium*, and twenty others uſed by *Tournefort*, are called *unworthy* names, which are for moſt part officinal, and for that reaſon are more neceſſarily and more eaſily to be inſcribed on the table of

* Vid. & § 222.—236.

† *Phil. Bot.* p. 161.

‡ *Phil. Bot.* p. 160.

|| *Crit. Bot.* p. 23.

of the memory, than his feigned ones, as *Atropa*, (from "*Atropos*, one of the furies," H. Cliff. p. 57 *. Phil. Bot. p. 171.); *Leontodon*, which shakes one disagreeably; *Convallaria*, an adjective, &c.: Who therefore multiplies existences without necessity, *Tournefort*, or *Linnaeus*?

69. In short, whoever diligently considers what this celebrated author † delivers concerning changing the generical names of plants, he will easily see that he advances with a full pace towards an intire innovation of the Botanical Science. For, there is no medicinal name of a plant, whether it be Greek, or Latin, but may be condemned with an equal right, or changed, as being *barbarous*, *compounded*, *diminutive*, of *difficult pronunciation*, of a *mongrel* or *mixed nature*, *unworthy*, *pathological*, or *not good* in many other respects, and some are changed by him, of which I have only given specimens. But, if this be done, there will be an end of the *materia medica* of our predecessors; for, all things must be necessarily disordered by a confusion of names. Such beginnings should be opposed.

§ XVIII.

70. Among the other extraordinary defects of the most famous *Linnaeus*, celebrated by Mr. *Peter Laing* ‡, he boasts much of the vague terms being

* *C. Linnæi Hortus Cliffortianus Amstelædami* 1737. in folio.

† *Fund. Bot.* § 220. ad 250. and elsewhere.

‡ *Amæn. Acad.* 2. p. 183.

ing tyed down to their proper seats, and the new ones introduced by him. Among the vague terms, I find *Scapus*; but, what is *Scapus*? "It is a kind of a trunk, and either naked, or covered with leaves," Fund. Bot. § 82. edit. 1. Yet, "*Scapus* with me is a kind of a trunk, which rises from the root, and supports the fructifications alone, without branches or leaves (except those placed at its root)," Fl. Lap. p. 8. * What I call a stalk, the most famous *Linnaeus* names a *Trunk*; of which there are three different sorts: 1. *A Stalk*. 2. *Culmus*, or the stalk of corn from the root to the ear. 3. *Scapus*, a kind of a trunk, which rises from the root, and supports the fructification alone without branches and leaves." *Gesfn. Differt.* p. 67. It is thus explained with perspicuity by both; but how these explications agree with the *Fundamenta Botanica* before cited, I do not see from both: especially since we have the *Anchusa scapis diphyllis*, H. Cliff. 47.; *Hemerocallis scapo ramoso*, corollis monopetalis, H. Upsal. p. 88. †; and *Tulipa scapo tryphylo*, foliis ovato lanceolatis, ibid. p. 82. These things do not well cohere.

The opinion is therefore to be changed; and *Scapus* is no longer to be called a kind of a trunk, but a *fulcrum*, or prop. For, in the Fund. Bot. edit. *Parisis*, in 1744. § 82. "*A Trunk* is a root above the earth; and it is of two sorts, *Caulis*,

* *C. Linnæi Flora Lapponica. Amstelædami 1737.*
in 8vo.

† *C. Linnæi Hortus Upsaliensis. Amstelædami 1748.*
in 8vo.

" or a Stem, and *Culmus*." And below. § 84.
 " The *Fulcræ*, or props of plants are nine, Brac-
 " tea, *Cirrus*, *Spina*, *Aculeus*, *Petiolus*, *Pedun-*
 " *culus*, *Scapus*, *Stipula*, and *Glandula*. — The
 " *Scapus* bears the fructification, and grows from
 " the root (not from the trunk)." But thus, the
Culmus will likewise be a prop; and why not a
 Trunk? since it is only a root above the earth, and
 sustains and bears the fructifications. Yet, neither
 do these things still please.

Hence, in the *Phil. Bot.* p. 39. "*A Trunk* brings
 " forth the leaves and fructification; its species
 " are six; *Caulis*, *Culmus*, *Scapus*, *Pedunculus*,
 " *Petiolus*, *Frons*, and *Stipes*; but *Ramus* is a
 " part of it;" and below, p. 40. "*Scapus*, is an
 " universal Trunk, which elevates the fructifica-
 " tion and not the leaves; as in the *Narcissus*,
 " *Pyrola*, *Convallaria* and *Hyacinthus*." But then,
 what must be said of the *Hemerocallis* and *Tulip*
 above mentioned? yea, of the *Convallaria foliis*
alternis, pedunculis axillaribus unifloris, *Lin. M.M.*
 p. 56.* However, the *Scapus* is thus excluded
 out of the number of *Fulcræ* or props. And in
Phil. Bot. p. 50. "*Fulcræ*, he says, are the props
 " of a plant, for its more commodious support;
 " to-day they are reckoned seven in number;
 " *Stipula*, *Bractea*, *Spina*, *Aculeus*, *Cirrus*, *Glan-*
 " *dula*, and *Pilus*." But yesterday they were
 reckoned nine in number, (to wit, in the *Funda-*
menta Botanica, published in 1744); and three
 days ago, (to wit, in the *Fund. Bot.* published
 in 1736), only six; and who knows how many
 there

* *C. Linnæi Materia Medica liber I. de plantis.*
Amstelædami 1748. in 8vo.

there will be to-morrow? Moreover, how fitly, and with what elegant Latinity are leaves to be called trunks; trunks, roots, &c.? Therefore the seat to which the *Scapus* is tyed down is unstable enough; which is likewise true of some other terms.

71. "A Berry, with Gesner *, is the pericarpium, whose seeds are lodged in a soft pulp; and these are either fixed to the pulp, as in the Strawberry; or they are covered with the substance of the pulp, as in the Berries of "Grapes." But *Linnaeus* † says, the Strawberry has no pericarpium; and the *Xanthium* ‡ has a dry pericarpium. "A Berry ||, is the Pericarpium stuffed, without a cavity, and besides it contains naked seeds." But the Pericarpium of the *Capicum* is a berry without pulp, bilocular, and hollow, according to the *Gen. plant.* p. 84. Yea there, p. 460. the Pericarpium of the Wall-nut Tree is a dry Berry; and the Seed a Nut; and therefore it should be called *Drupa*, (or rather *Druppa*), since "Drupa is the pericarpium stuffed, without a cavity, and contains a nut," p. 53. How manifold is a berry, since the Pericarpium of the *Rhus*, *Solanum*, *Cyclamen*, *Mespilus*, *Aurantium*, *Ananas*, &c. is thus named.

72. "A *Strobilus*, says Gesner |||, is a fruit formed of scales laid one under another like tiles

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* *Dissert.* p. 101.

† *Gen. pl.* p. 220.

‡ p. 452.

|| *Phil. Bot.* p. 53.

||| *Dissert.* p. 101.

"on the roof of a house, in whose sinuses or angles seeds are lodged." But, with *Linnaeus* *, *A Strobilus* is a Pericarpium formed of an *Amentum*. And "an *Amentum* † is a calyx formed of "a common chaffy and bud-like receptacle." Yet, in the characters of his *Gen. Plantarum*, I do not find a *Strobilus* represented as a Pericarpium, except in the *Magnolia* alone, where there is no *Amentum*, but the calyx is a Perianthium with three leaves, to which nine stamina belong, and the pericarpium is an oval *Strobilus*: while the *Abies*, *Alnus*, *Betula*, *Carpinus*, *Cupressus*, *Larix*, *Lupulus*, and *Tulipifera*, have no pericarpium. This term occurs, but very seldom, in the specific denominations; for I have only observed it thrice in the *H. Cliff.*; to wit, *Carpinus squamis strobilorum planis*; & *Carpinus squamis strobilorum infatis* ‡, & *Thuja strobilis laevibus, squamis obtusis* §. *A Capsula*, with *Cesler* |||, is a membranous and roundish Pericarpium, as in the *Auricula Urfi*. But, with *Linnaeus* ††, it is a hollow Pericarpium, gaping determinately. Yet, the Pericarpium of the *Epilobium* ††, is a very long, cylindrical, striated, quadrilocular, and four-valved *Capsula*: neither roundish, nor hollow, nor gaping determinately, but through its whole length. How perspicuously

* *Phil. Bot.* p. 53.

† *Ibid.* p. 52.

‡ p. 447.

|| p. 449.

||| p. 101.

†† *Phil. Bot.* p. 53.

†† *Gen. pl.* p. 162.

perspicuously are the botanical Elements of Linnæus explained, by Gesner, or Linnæus himself! It is astonishing that such things should please Botanists!

73. " From the characters of the genera of the
" celebrated Linnæus, says Mr. Løsting *, which
" are delineated to the life, and according to all
" the parts of the fructification, almost all the Bo-
" tanists of this day have formed new methods for
" themselves; which indeed is now as easy to be
" done by every one, as it was difficult and ardu-
" ous before him. For, he has not only tyed down
" many vague terms to their proper seats; but
" likewise has introduced evidently new parts and
" new terms, as the *Nectarium*, *Drupa*, *Fulcrum*,
" &c. which were not mentioned before him,
" though the Botanists of our day glory in them:
" Who is there destitute of them, that can at this
" day give a perfect description of a plant?"
Thus Linnæus's scholar, or Linnæus himself.

But, with the author's leave, I must be of a very different opinion. For, it is not only, not less injurious to the study of Botany, to contrive new methods without necessity, than to invent names and useless terms; and it is likewise as difficult, yea, more difficult, from those characters, howsoever delineated to the life, to form a new and at the same time an useful method, as it was before him.

74. For, concerning the characters of the genera, three things are principally to be observed.
1st, That the characteristic marks of the genera

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* *Aman. Acad.* p. 183.

ought not to be multiplied without necessity; nor more of them, than is requisite to determine the genus with certainty, to be heaped together; lest, to wit, the memory be too much burthened, and instead of characteristic signs we seem to give a description of the plant. 2dly, That the characteristic marks, in all the species of the same genus, should be exactly alike; and those parts of the fructification, in which all the species do not agree, must be omitted. 3dly, That they ought to be very obvious, manifest, and sufficiently observable by every one. For, since the chief use of a method is, to lead the ignorant and learners to the knowledge of plants, by a compend, without tediousness and difficulty, such marks should not be proposed, as require an attentive and careful spectator, so that it shall thereby be necessary for every one to carry a microscope about with him*.

The most famous *Linnaeus* remarks †, that *Ray* was wrong in laying down this last rule, and advises all the parts of the fructification to be examined, even those that escape the sight, though a microscope should be used. Yet, he acknowledges, that no character is infallible, before it is regulated according to all its species. And, he adds, “The character is made natural by a very accurate description of the first species of fructification; all the other species of the genus
“ must

* Vid. *Tournefort*, p. 50; and *Ray's Rules* prefixed to his *Methodus plantarum emendata et aucta* Londini 1703. in 8vo.

† *Phil. Bot.* p. 131.

" must be compared with the first, and by excluding all the marks wherein they differ, at length it becomes elaborate *."

75. But, that the *Linnean* characters are not elaborate, the author confesses; saying, " A genus is rarely to be observed, in which some part of the fructification does not vary," *Fund. Bot.* § 179. And he adds in *Phil. Bot.* p. 121. " Unless this rule is taken, as many genera would be reckoned, as there are species that exist." But if he had observed the first rule given above, this rule would have been unnecessary, and almost no variation of the species would have happened. Of which matter he himself now seems to be conscious: for, in the preface to his *Systema Naturæ*, he says, " I have assigned new, and those very compendious characters to plants, when I could not always find out such as are essential, that learners might the more easily distinguish and know them asunder." And for this reason, this contracted system is much more useful than those things which the sexual method brings to its assistance, than the diffuse characters whereof Mr. *Lofting* boasts. For, that unhappy method confounds every thing.

76. Because, the number of the stamina, being very various, it renders the searching out of the genera exceedingly difficult, yea, and often impossible, by a learner. Who, I pray, looking at the *Tamariscus Germanica*, B. P. that was unknown to him, which has ten stamina, would consult the fifth

* *Id. Ibid.*

fifth class, or Pentandria, for its character? Who would seek the character of the *Valeriana rubra* Dod. in the third class, or Triandria? Of the *Gratiola centauroides* B. P. in the Diandria? Or, of the *Rhodia radix* B. P. in the twenty-third class, called Polygamia, betwixt the *Fraxinus* and *Empetrum*; or would separate it from the *Anacampteros*, or *Sedum*, of *Linnaeus*; or the *Sedum* itself from the *Sempervivum*? And so of innumerable others. Hence it evidently appears, that the genera, all of them at least, are not natural; or, if they are to be called natural, as the celebrated *Linnaeus* often asserts*, an agreement in all the parts of the fructification is not required to constitute them, and they are wrongly constituted by it. But, why the genera are to be called natural, rather than classes and orders, I do not as yet see.

§ XIX.

77. If the celebrated *Linnaeus* had spent a tenth part of that time which he has bestowed on the specious contrivance of systems, new names, &c. in amending the method of *Morison*, *Ray*, or *Rivinus*, he would have done much more service to this beneficial art. For, the invention of the sexual system seems scarce worthy of the famous *Burckhard*; or, it is scarce worth while for the celebrated *Heister* to contend about it, in his learned preface to *Burckhard's* epistle: wherein he treats of the inventors of a method of plants, shews that the author of the epistle is the inventor of the sexual

* Vid. *Gen. pl. pref.* p. 2. *Syst. nat.* p. 216. *Fund. Bot.* § 160.

sexual method *, and celebrates his merit together with that of *Joach. Camerarius*, and *Joach. Fungius*, which has been hitherto commonly neglected; and suggests some other things to illustrate the history of the Botanical Science.

In § 52. he speaks thus: "And especially after, "*Fungius*, *Malpighius*, and likewise *Menzelius*, "*and others, were engaged in making farther* "*inquiries concerning the sexes of plants; but* "*afterwards in the clearest manner, of all others,* "*Rud. Joach. Camerarius, (in 1694); also Burck-* "*hardus, (in 1702); Waldschmidtus, (in 1705);* "*Gakenbolzius, (in 1706); and at last, a long time* "*after these, Vaillantius, a Frenchman, (in 1717),* "*who, in writing and speaking of them, intirely* "*suppreses the names of these his most excellent* "*predecessors; but for what reason, I know not;* "*as if this doctrine was something quite new, and* "*not heard of before."* See his Preface, p. 70. But here the good *Homer* nods, or is mistaken.

78. For, 1st, He himself has suppressed, intirely without reason, the name of *Grew*, who in the year 1676, and first of all, delivered the late opinion concerning the sexes of plants, and explained it very distinctly; and likewise *Ray's* name, who was the first, as far as I know, that embraced *Grew's* opinion. While also *Burckhard* himself writes †, "I have determined now to consider, "*whether*

* *Jo. Hen. Burckhard, Epistola ad G. G. Leibnizium, cum L. Heisteri prefatione. Helmstadii 1750. in 8vo. Vid. pref. p. 76. 84.*

† *Epist. p. 146.*

“whether the orders of plants may be modelled
 “by those parts, *which from their office I am about*
 “*to call genital:*” though the same things had
 been said long before by *Grew*.

2dly, *Malpighius* not only does not admit the
 distinction of sexes; but also seems to believe that
 the petala and stamina are as it were emunctories,
 and only employed in the purification of a disagree-
 able humour *: nor does *Jungius* allow it, unless
Camerarius is mistaken, who writes thus: “Both
 “these histories of generation have undergone al-
 “most the same fate, and have been successively
 “and gradually improved by the moderns, since
 “what *Harvey*, *Steno*, and *Swammerdam*, had ob-
 “served in animals, *Grew* and others have at the
 “same time taken notice of in plants. What
 “therefore forbids us in any measure to ascribe
 “properly to plants a male and female, and con-
 “sequently a difference of sex, *though Jungius is*
 “*against it*; and the rather, because in the mo-
 “numents of the ancients, to wit, in the writings
 “of *Aristotle* and *Theophrastus*, the author has ob-
 “served the traces of this opinion, as in his second
 “appendix he particularly informs us.” Thus
Camerarius, as he is quoted by *Valentinus* †.

3dly, *Camerarius* himself doubts of this doc-
 trine; yea, refutes it by an experiment: for, he
 saw many fruitful little grains and seeds, obtained
 from solitary female plants of the *Mercurialis*, *Spin-
 nachia* and *Cannabis*, nursed in places where they
 had no communication with, or contagion from,
 a neighbouring male. And therefore, though it
 were

* *Vid. p. 70.*

† *l. c. No. 41.*

were found by experiments, that, "if the An-
"theræ, as soon as flowers are opened, be cut off,
"that these flowers do not produce fruit, or
"seeds *;" (which, however, is not true); it
by no means thence follows, that these are really
the genital organs; as we have already shewn
(No. 43).

§ XX.

79. Yet, the most famous *Linnaeus* deserves the
highest praises; principally on a double account.
1st, Because he distinguishes the species of plants
from their varieties, more accurately than any o-
ther Botanist. And, 2dly, Because he takes the
specific names, not from the accidents of place,
time, inventor, use, &c. as is customary, but from
the essential parts of plants, in which those of the
same genus really differ from one another. "I
"have placed, *he says* †, the varieties under each
"species, though it is a most audacious attempt,
"since varieties, by my contemporaries, not to say
"all, securely enjoy the privilege of species ‡."

Care however should be taken that we fall not
into the opposite extream, so that species are taken
for varieties: This Scylla is not less to be avoided
than Charybdis. Whether therefore are all the
Pæonia of *Tournefort* to be reckoned varieties; the
Lapathum folio acuto rubente B. P. & *Lapathum*
aquaticum, folio cubitali ejusdem; *Convolvulus*
major

* *Vid. Heist. præf. p. 72.*

† *Præf in H. Cliff.*

‡ *Vid. Fund. Bot. § 256. ad 305.*

major albus B. P. & Scammonia Syriaca ejusdem ; Rhabarbarum T. & Lapathum folio rotundo alpinum J. B. ; Sorbus sativa B. P. & Sorbus aucuparia J. B. ; Euonymus vulgaris B. P. & Euonymus latifolius ejusdem ; Cerasus sylvestris, fructu nigro J. B. & Cerasa acida nigricantia solidiora tardius maturescentia ejusdem ; and some others, as the illustrious author of the H. Cliff. would have it, is deservedly to be doubted. For, I always esteemed every diversity in plants, which is very remarkable, if it be also stable, or which neither arises from culture, nor is mutable, to be a specific difference ; as the famous *Ray* teaches. “ No more
 “ certain mark of specific (as they call it) distinction, *he says*, hath occurred to me, though I
 “ sought long for it, than a distinct propagation
 “ from the seed. Therefore, whatsoever differences arise from the seed of the same plant,
 “ are accidental, and not specific. But such as
 “ never come forth from the seed of the same
 “ species, are then to be accounted specific *.” And yet he himself frequently deviates from this precept ; and *Tournefort* plainly acknowledges, that he little regards, whether they are varieties, or species, which he mentions, if they do but differ, in some circumstances natural to them, which are obvious to the senses.

So. “ I have every where, says *Linnaeus* †, given to plants new specific names, because
 “ worthy old ones are scarce to be found any
 “ where. I did not set out in this enterprise,
 “ from

* *Vid. Raii Hist. pl. p. 40.*

† *l. c.*

“ from a belief that my own specific names are as
 “ excellent as the others, but because far shorter,
 “ more certain, and therefore more proper ones,
 “ may be contrived : for, I ought rather to try a
 “ doubtful than no remedy of botany, since its
 “ prosperity is only to be hoped for in this way.”
 And elsewhere *, “ The specific name, at the
 “ first sight, will discover its own plant ; because
 “ it contains the difference from all that are of the
 “ same genus which is inscribed on the plant its
 “ self.” But to express this difference elegantly
 and briefly in words, is an arduous enough under-
 taking, and actually worthy of *Linnaeus*.

And caution is likewise to be used here, when
 the species of any genus are numerous, lest de-
 scriptions be given instead of names. Hence *Lin-*
naeus says, “ The number of words which are
 “ used in the difference, never admits of more
 “ than twelve words : for, as the generical names
 “ will consist of twelve letters at the most, so like-
 “ wise should the difference consist of twelve words,
 “ that their limits may be at length established.”
 Then he endeavours to shew by a calculation,
 (which I do not understand), that though a genus
 contains a hundred species, which number he knows
 no genus to have reached, that twelve words at the
 most are scarce ever necessary, for the difference
 of the genus which comprehends a hundred species.
 He adds, “ The very long specific names of the
 “ *antients* are therefore to be dreaded, which
 “ comprise descriptions instead of differences ;”
 and cites three examples, two out of *Plukenet*,

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and

and one out of *Breynius*, which moderns are ancient enough *.

81. But that twelve words are required for the specific difference, when the number of plants of the same genus is much less than a hundred, will appear by an example. The *Cataputia* of the shops is a species of the *Tithymalus* with *Morison*, and from thence with all systematic writers, before the illustrious *Linnaeus*, who prefers to *Tithymalus*, or *Tithymallus*, both used by *Hippocrates* himself, *Euphorbia*, a much more modern name. This *Cataputia* is the *Tithymalus latifolius*, *Cataputia dictus*, H. L. 599. †, & T. 86. *Euphorbia inermis*, foliis oppositis lanceolatis, umbella universali trifida polyphylla, partialibus triphyllis, reliquis diphyllis, H. Cliff. 198. Or the *Euphorbia inermis*, foliis oppositis lanceolatis, umbella universali quadrifida, tetraphylla, (*ulterioribus dichotomis*), H. Upsal. 140. reliquis dichotomis, Lin. M. M. 90. And therefore, in the one there are thirteen, and in the other eleven words; or rather eighteen simple words in the former, and fifteen in the latter: though the author does not admit forty species of the *Euphorbia*. These are therefore very long names; nor are the *Plukenetian* above-mentioned much to be dreaded, though they are less accurate than the *Linnean*: yet, it must be a strong memory that can retain them.

Hence he now admits sufficiently short specific names, which he calls *Trivial*. "The legitimate

* *Phil. Bot. p. 228.*

† *Pauli Hermannii Hortus Academicus Lugduno-Batavus. Lugd. Bat. 1687. in 8vo.*

“ specific name, distinguishes a plant from all those
 “ of the same genus; but the *Trivial* name is
 “ hitherto subject to no laws. ——— The specific
 “ name is therefore the essential difference. *The*
 “ *trivial names* may perhaps be allowed; in the
 “ manner in which I have used them in the *Panis*
 “ *Suecicus*, if they only consist of one word, and
 “ are every where freely chosen. I am convinced
 “ of it, chiefly for this reason, that the difference
 “ often becomes long, so that it cannot be every
 “ where conveniently used; and also it is liable to
 “ be changed, when new species are discovered *.”

He has likewise made use of them in the *Gemma*
Arborum†; yet they do not always consist of one word,
 but often of two, and sometimes of three words, with-
 out regarding in the least the essential difference.

Thus the *Tithymalus helioscopius*, B. P. 291. is
 the *Euphorbia inermis*, foliis subrotundis crenatis,
 umbella universa multifida polyphylla, partialibus
 trifidis, propriis tryphyllis, H. Cliff. 198. Or the
Euphorbia foliis crenatis, umbella universali quin-
 quefida pentaphylla, partialibus trifidis, propriis
 triphyllis, H. Cliff. Fl. Suec. 159. † and the *Eu-*
phorbia Solisequia, Pan. Suec. Amæn. Acad. 2. 249.

The *Gramen caninum arvense*, B. P. 1. is the *Tri-*
ticum radice repente, foliis viridibus, H. Cliff. 24.
 and the *Triticum rad. officinarum*, P. S. Amæn.
 Acad. 240. The *Salix pumila folio rotundo*, J. B.
 1. 2. 217, is the *Salix foliis integris glabris ovatis*,
 subtus reticulatis, Fl. Suec. 292. and the *Salix folio*
subtus reticulato, P. S. Amæn. Acad. 2. 2602.

The

* *Phil. Bot.* p. 202.

† *Amæn. Acad.* 182—223.

‡ *C. Linnei Flora Suecica.* Lugd. Bat. 1745. in 8vo.

The *Leonicera*, *Xylosteum*, Fl. Suec. G. A. Amæn. Acad. 2. 202. is the *Leonicera* pedunculis bifloris, baccis distinctis, foliis integerrimis, Fl. Suec. 67. The *Lonicera*, *Periclymenum Germanicum*, Fl. Suec. G. A. Amæn. Acad. 2. 203. is the *Leonicera* floribus capitatis terminatricibus, foliis omnibus distinctis, Fl. Suec. 67. The *Acer folio sub-
tus glauco*, H. Upsal. G. A. Amæn. Acad. 204. is the *Acer foliis quinquelobis acuminatis acute
ferratis*, petiolis teretibus, H. Upsal. 94. and so of the rest. This is a recent, and very rich mine, out of which new names are to be dug at pleasure.

Yet, it is most certain, that *Linnaeus's* legitimate specific names are of so great use in Botany, that they often shew a more certain and perspicuous difference of the species, than can be easily gathered from the prolix descriptions of some writers. Neither are the trivial names to be despised as useless, if they are only taken from the legitimate specific, or synonymous marks; since those perhaps alone are to be properly called names, and which should not be multiplied without necessity.

§ XXI.

82. Those species of plants that agree in most parts of the fructification, especially in the flower and fruit, are judged to be of the same genus; as the great *Conradus Gesnerus* first taught, who was born at Zurich, in 1516; and died there of the plague, in the year 1565, in the 49th year of his age, "while he was laying the foundation of Botany,

" tany, which afterwards laboured under many
 " imperfections, because those that lived after him,
 " did not follow his footsteps *."

Gesner's Botanical works, which for a long time have been lamented as lost, still exist in manuscript, and perhaps at length will see the light. For, *Job. Geor. Volckamerus*, in his explications of the abbreviations in the *Flora Noribergensis* †, speaks thus: " The author of this Catalogue has
 " in his possession figures of both alpine and exotic plants, which were painted to the life, and briefly describ'd by *Conradus Gesnerus*." There is likewise in this manuscript, "*Conradus Gesnerus's*
 " history of plants, with their virtues," as a distinct work. We are also informed by the illustrious *Heister* in his above-mentioned preface ‡, that *Joachim Camerarius*, a Physician and Botanist of Norimbergh, bought that botanical treasure, not long after *Gesner's* death, of his heir *Caspar Wolfius*, with a design to publish it: that from *Camerarius* it afterwards came into the hands of the *Volckamer's*, where it laid neglected for a very long time, and from them at length, in the year 1744, when the last *Volckamer* died, to the illustrious *Trew*, likewise a most excellent Botanist of Norimbergh.

83. But the right way of constituting the genera, " Perhaps would have still lain in darkness,
 " unless *Robert Morison*, of *Aberdeen in Scotland*,
 " had

* *Vid. Tournesf. p. 50. 53.*

† *Johannis Georgii Volckameri Flora Noribergensis. Noribergæ 1700. in 4to.*

‡ p. 11.

“ had reformed and restored it, which was as it
 “ were alienated by Herbarists, and first applied
 “ it to constant use; for which service high en-
 “ comiums ought to be conferred on him; but he
 “ would have merited far greater, if he had ab-
 “ stained from self-praise * ” *Robert Morison* was
 born at *Aberdeen* in the year 1620, and died at
London in 1683. He was without doubt an eminent
 Botanist, seeing he was much celebrated even by
 his cotemporaries. “ *Robert Morison* an English-
 “ man, (says *Mentzelius*), a Physician, and the
 “ most diligent Botanist of our seventeenth centu-
 “ ry. Besides a new distribution of plants into
 “ certain classes, &c. he has wrote an *Hortus Re-*
 “ *gius Blesensis, Præludia Botanica, &c.*” *Vid.*
Ment. Ind. Elench. auctorum †; where there is no
 mention at all made of *Fungius*. “ In the lists of
 “ names, (says the famous *Herman* ‡), I have fol-
 “ lowed the guidance of the principal Botanical
 “ writers of our age; *Caspar* and *John Baubine*,
 “ as also *Robert Morison*, and others, in whom we
 “ may find plants that are omitted by the already
 “ commended authors.” And below, “ *Morison*
 “ will principally instruct you in the character
 “ of a plant, *Caspar Baubine* in the synonymous
 “ names, &c.” And in another place ||, “ *Mr.*
 “ *Robert Morison*, who, while he lived, was by
 “ far

* *Tournef. p. 53.*

† *Index Nominum plantarum multilinguis, opera*
Christiani Mentzelii. Berolini 1682. in folio. Ejus-
dem Pugilus rariorum plantarum ad calcem Indicis
editur.

‡ *Præf. in H. L. Bat.*

|| *H. L. Bat. p. 164.*

for the most famous Professor of Botany in the
 " university of *Oxford*, sent me this Cnicus, which
 " was gathered about *Tangier*." Neither do I
 here find *Jungius*'s name, nor in *Volckamer*, *Tourne-*
fort, or *Boerhaave*.

84. I am sorry indeed, that the famous *Heister*
 thinks otherwise of *Morison*. For, he writes thus
 in the preface already commended, p. 36. " Most
 " writers who have treated of the rise and pro-
 " gress of Botany, when they speak of *Casalpini*,
 " or even of *Columna*, complain, that for a very
 " long time after him, the Botanical science lay
 " as it were unimproved and contemned, and take
 " a leap from *Casalpini*, or from this *Columna*,
 " directly to *Morison* and *Ray*, who were both
 " Britons, lived at the same time in England, and
 " published writings concerning Botanical method
 " almost towards the end of the last century, and
 " have attributed especially to *Morison* almost all
 " the glory of inventing a method: but yet, as is
 " to be here remarked, *Morison* in his first Bota-
 " nical writing, which he intitled *Præluia Bo-*
 " *tanica*, and published at *London* in 1669, in 8vo,
 " has only recounted in alphabetical order the
 " plants of the Garden at Blois, which *Casson*
 " *Duke of Orleans*, a little before this time, cul-
 " tivated in France, and of which for some years
 " he was Overseer; and likewise the mistakes,
 " which he believed he had first observed in the
 " writings of *Caspar* and *John Baubine*; (yet our
 " *Jungius* had already before him remarked a great
 " many of them). But in the preface of his book,
 " *Morison* there boasts very much, that he first

“ found out a method of plants, which no one had
 “ till then thought of; yet he has not even di-
 “ vulged it in this treatise.” And below, p. 40.
 relating what *Jungius* has done in his *Doxoscopiaz*,
 “ Part 2. § 3. (he says) in the proæmium, he be-
 “ gins thus: Unless plants are reduced into certain
 “ genera and species by a constant scheme, and not
 “ according to the fancy of this or the other per-
 “ son, the study of the knowledge of vegetables will
 “ be rendered as it were infinite. For, the human
 “ understanding sounds infinity, because infinite things
 “ cannot pass through it. But an order of classes,
 “ genera, and species, puts an end to infinity*.
 “ From which it appears, that this excellent man
 “ here pointed out the true and principal founda-
 “ tion of Botanic method; and that afterwards all
 “ methodical Botanists followed his opinion.” He
 gives many other instances of this, and honours
 him with high commendations; to detract from
 which I have no inclination.

85. Yet, I may observe by the by, that the
 most famous *Heister* adduces no example of the
 character even of one genus being constituted by
Jungius, or of an enumeration of its species:—
 while what he writes of plants in general, of
 flowers, or concerning the use of method, occur
 much more clearly in *Cesalpinus*; from whom, as
 far down as *Morison*, there is a total silence con-
 cerning the constitution of a method of plants.
 But that *Morison* was assisted by *Jungius*'s obser-
 vations,

* See what are cited out of *Cesalpinus*, *infra*,
 No. 86.

vations, or borrowed any thing from him, is very
 improbable. For, the edition of the *Hortus Ble-
 sensis* in 1669 is the third edition, the second having
 come out at *Paris* in 1655. In the preface to the
 third edition, he says, "I have now in my custody my
 " new method, which ranks all the classes of vege-
 " tables in tables according to their kindred; but
 " I cannot spare money wherewith to defray the ex-
 " pence of the work of designers and engravers."
 And in the preface to his dialogue, writing to Mr.
John Fell, "These my *Prælia Botanica*, pave
 " the way to my new method, of which I have
 " shewn you the copy." And in the dedication
 of the *Hallucinationes*, "*Gaston Duke of Orleans in*
 " *France*, desired me to take notice of the over-
 " sights of *Caspar Baubine*, who was superior to all
 " the Botanists that wrote before him; and com-
 " manded me to do it, while I dwelt at Blois,
 " where I lived for some years." He was over-
 seer of the garden at Blois, from the year 1650 to
 1660, when the Duke died. Mr. Ray observes *
 that specimens of *Morison's* method were published
 before the year 1667. But the *Isagoge phytosco-
 pica* of *Joachimus Jungius*, was not printed at *Ham-
 burgh* before the year 1678, as Mess. *Heister*, *Se-
 guierius*, and *Linneus*, have it; or 1679, as it is
 in Ray's *Hist. plant.* and *Tournefort's Inst.* edit.
 1710. "From whence it might, (says the most
 " famous *Heister*, p. 39.) easily come into Eng-
 " land to *Morison* and *Ray*, as also it was undoubt-
 " edly brought thither, since *Ray* hath often com-
 " mended both him and his books." Ray indeed,

O 2

in

* *Præf. in meth. emend.*

in the first volume of his Hist. pl. published in 1686, often commends *Jungius*, and sometimes corrects him; but makes no mention of his *Doxoscopia physica*. It does not therefore appear that *Morison* ever saw any of *Jungius's* books.

§ XXII.

86. Now, after the genera are carefully established, another point of botanic doctrine, on which great stress is to be laid, consists in their disposition; which ought to be so ordered, as may conduce most towards conveying a plainer and shorter knowledge of plants. This will be easily obtained, if the genera are distributed into some classes, in such a manner, as that by their aid the names of plants are marked out immediately, and without an instructor. But a number of genera accumulated into one regular series, is denominated a *class*; which genera have some one common and so proper a mark, that they differ entirely from all the other genera of plants. And indeed, *Andreas Casalpini*, of *Arezzo*, who was born in the year 1519, and died at *Rome* in 1603, discussed this part of Botany with the greatest exactness, before it was attempted by any one; and he alone amongst Botanists has left us a way of ranging plants by classes, worthy of a philosopher.*

In this immense multitude of plants, (says *Casalpini*), that I see is wanted which is wont to be much sought for in any disordered army

* Vid. *Tournef.* p. 51. & 66.

“ of soldiers whatsoever : for, unless they are
 “ brought into inferior ranks, and, like the front
 “ of an encampment, distributed into their own
 “ companies, all things must be necessarily dis-
 “ turbed with tumult and uncertainty. This we
 “ also now find to happen very much in a confi-
 “ derable number of plants : because, when the
 “ judgment is overthrown by an irregular multi-
 “ tude, inextricable errors, and morose alterca-
 “ tions, generally arise : for, while the proper
 “ genus is unknown, no description, though ac-
 “ curately given, demonstrates a plant with cer-
 “ tainty, but for most part is fallacious. There-
 “ fore, while the genera are confused, all things
 “ must be necessarily confounded, &c.” *Vid. Casalp.*
L. I. pref.

87. “ Though the systematic distribution of
 “ plants was long ago discovered and promul-
 “ gated to all the world by *Casalpinus*, yet it re-
 “ mained, for near a whole century, unmeddled
 “ with and neglected, even till, by good luck, it
 “ was first revived by *Morison*, who was born to
 “ advance Botany. He does not indeed say one
 “ word about *Casalpinus* ; yet this will not seem
 “ wonderful to those, who examine how much
 “ *Morison* has deviated from the *Casalpinian* laws :
 “ he has certainly departed from those rules, more
 “ than the other systematic writers who succeeded.
 “ *Morison*, who neither themselves have sung his
 “ deserved praises.” Thus *Linneus* *.

88. Here he seems to shew, that *Ray*, who was
 “ highly,
 “ * *Syst. plant. p. 33.*

highly displeased with *Morison*, treats him rudely after his death, and indeed in an unusual manner. For, in the explication of names in his *Hist. Plant.* he has these reflections: “*Robert Morison*, as long as he kept himself within his own bounds, and was employed in composing Catalogues of Gardens, searching out the characteristic signs of the genera, and in detecting and correcting errors, or (as he loves to speak) blunders in the disposition of the species of vegetables, he truly deserved praise. But when he would please himself too much, and being full of himself, would likewise despise others more learned than himself, daring to attempt things superior to his abilities, and to write an universal history of plants, he neither consulted his own reputation, nor satisfied the expectations of many persons.”

And in the preface to his *Methodus Plantarum emendata & aucta*, he writes thus: “In the year 1667, the most reverend Dr. *John Wilkins*, Bishop of Chester, solicited me strongly, to reduce trees and herbs into some method, in order to complete the philosophical Tables for an universal character, (whereof a specimen at that time came to light); yet in this I was not at liberty to follow the order of nature, but obliged to distribute both kinds into only three subordinate kinds; (for, the nature of my design allowed of neither more, nor fewer). Howsoever, not presuming to deny any thing that so great a friend requested of me, I executed that work in a hurry, and almost immediately. Mr. *Robert Morison*, of *Aberdeen*, in *Scotland*, M. D. “being

" being highly offended with it, fearing perhaps
 " lest thereby his fame and authority should be in
 " any degree lessened, of which he had, and not
 " undeservedly, gained to himself no small share
 " among Botanists, by publishing specimens of his
 " method, which he boasted he did not extract
 " from books, but that he was taught it by nature
 " herself, and taking it ill that I dared to put a
 " sickle into his harvest, he reviled those Tables in
 " an unbecoming manner, while he concealed the
 " name of the author. Though I should acknow-
 " ledge that that method was obnoxious to cen-
 " sure, and not only imperfect, but in many re-
 " spects erroneous and amiss; yet, when I saw
 " myself despised and plainly ridiculed by a man,
 " who is vain and full of himself, not to say any
 " thing more severe, or disquiet the soul of the
 " dead, that I might in some measure take care of
 " my own credit, I resolved to try what I could
 " do, in digesting plants, and planning out a me-
 " thod, by freely following the guidance of na-
 " ture; and at length, after long and mature de-
 " liberation, I compiled that distribution, from
 " comparing my own observations with those of
 " others, which I afterwards published, under the
 " title of *Methodus plantarum nova*, in the eightieth
 " and second year of the last century." Nor do I
 " know what he could have said more severe.

89. Howsoever, the whole cause of this scold-
 ing, as far as I can find, was this. In a *Dialogue*
 betwixt a Fellow of the Royal Society and a Bota-
 nographer*, the Fellow says, " Undoubtedly, I
 " have

* *Morif. Pral. Bot. p. 476.*

“ have thought that a generical mark is taken
 “ from the resemblance of the leaves. The Bo-
 “ tanogr. And I have observed this in many au-
 “ thors, who wrote some years since ; yea lately,
 “ in a certain book, published by an author who
 “ is a Fellow of your College, wherein a method
 “ of plants taken from the resemblance of their
 “ leaves is exhibited, and the classes are disposed
 “ in tables. I only found it a confused Chaos : I
 “ read therein concerning plants, but I learnt no-
 “ thing ; and I will shew you its mistakes and
 “ confusion at another time, because I must not now
 “ digress.”

“ go. Though there is no occasion to vindicate
 Morison in the opinion of the learned ; yet I shall
 transcribe a few things, out of his life and the
 preface, which are prefixed to the third volume of
 the Hist. Pl. Oxoniensis. “ He was a most candid
 “ man to shew to all, and teach all, his method,
 “ both by his writings and conversation, being
 “ envious of no person’s fame, while his own was
 “ secure, to which he always preferred the public
 “ good. For, Morison’s reputation is not to be
 “ despaired of, as long as Ray’s *Synopsis stirpium*
 “ *Britannicarum*, or the *Historia plantarum* of the
 “ same author, will be valued by Botanists : in
 “ both which there is not a page, filled with
 “ how much soever ornament and instruction,
 “ where Morison’s genius does not shine.” Vid.
 Moris. vita, p. 4. ; and there we have also the
 opinions of Ammannus, Breynius, Cupanus, &c. con-
 cerning him.

“ In

“ In the mean time *Aberdeen*, very luckily,
 “ brought forth *Robert Morison*, the unrivalled
 “ chief of all Botanic writers, how many soever
 “ they were; to whose guidance, unspeakable
 “ penetration, and most successful studies, students
 “ of Botany owe more, than to all the labours of
 “ the antients. Every one may be speedily con-
 “ vinced of this, who will carefully consider his
 “ animadversions on *John* and *Caspar Paubine* in
 “ his *Praeludia Botanica Blesensia*, & *Hist. Oxoni-*
 “ *ensis*: and, as the most famous *Paulus Amman-*
 “ *nus* justly remarks, which I am not ashamed to
 “ repeat, in these nervous works of *Morison*, more
 “ lustre, more truth, and more advantage accruing
 “ to lovers of medicine, are contained, than in all
 “ the very numerous volumes, which are intersper-
 “ sed with connexions of the antients: let the pri-
 “ vate judgment, of every one who is impartial and
 “ unprejudiced, be arbitrary.” These things were
 said by the most famous *Bobart* in the above men-
 tioned preface, about six years before the death of
John Ray. *Morison*’s *Hist. Oxon.* is likewise much
 commended by the great *Boerhaave* *. “ These
 “ things prove that *Morison* (to speak again with
 “ the author of his life) durst write the *Historia*
 “ *Oxoniensis*, and both consulted his own reputation,
 “ and satisfied the expectations of the learned: al-
 “ though he presumed to deny it, who owed all
 “ his improvements in Botany principally to *Mo-*
 “ *rison*.”

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P

6 XXIII.

* *Ind. alt. pl. pref. p. 17.*

§ XXIII.

91. As I judge that the character of the genera is to be borrowed the most conveniently from the fructification, so I think that of the classes is to be taken the most commodiously from the flower, in the more perfect plants; in others from the habit, or external facies; but the characteristic of the orders, or sections of the classes, from the fruit; as from the most essential and visible parts. And this is *Tournefort's* method *, which is by far the easiest of all others, and the most useful to learners, as I before observed. I confess, with the most famous author, that it is not finished; nor am I ignorant of what has been animadverted upon it by the learned, as by *Ray*, *Dillenius*, &c. but especially by the most famous *Jussieu*.

92. Yet, I know not, whether by taking out or obliterating the spots or imperfections which are observed in the *Institutiones rei herbariae*, their elegance and utility would be much heightened: while a system absolutely perfect, is not to be expected from this age, if it ever be consummated. In the mean time we enjoy these, earnestly intreating the celebrated and most humane Mr. *Bernard de Jussieu*, to put the last hand to them, and rescue Botany from the various difficult trifles and fooleries; with which it is burthened and almost oppressed.

Those

* *Vid. Inst. p. 65. 66. 67.*

Those that would be acquainted with what others have done towards compleating a method of plants, may peruse the authors themselves; or the celebrated *Carolus Linnaeus's classes plantarum*, seu *systemata plantarum omnia à fructificatione desumpta*, quorum xvi. universalis, & xiii. partialis, compendiose proposita, secundum *classes*, *ordines*, & nomina *generica*, cum clave cujusvis methodi, & synonymis genericis. *Fundamentorum Botanicorum*, pars ii. Lugd. Bat. 1738. in 8vo.

§ XXIV.

93. It would take up too much time to expatiate on the uses of plants. We cannot live without them. For, whatsoever things are necessary for food, whatsoever things are esteemed delicacies, they abundantly supply; they not only afford sustenance, but likewise cloathing, and medicines, and houses, and ships, and household-furniture, and fuel, and recreations of the senses and mind. But we think it needless to dwell on these things. *Ray's Hist. Pl.* p. 46. may be consulted on this head.

94. However, we may remark, with respect to their medical use, that no method of Botany is of so great service towards investigating the virtues of plants, as is pretended by some; the first of whom was *Casalpinus*, who, in the preface to his treatise on plants, writes thus: "At length even the powers, which physicians most seek for as their properties, are discovered from a know-
P 2 " ledge

“ ledge of their natures ; those that are associated
 “ in the same genus, for most part possess similar
 “ powers ;” which others fully prosecute ; particularly *Frederick Hoffman*, who was Professor of Medicine at *Hall*, in his Dissertation concerning a compendious method of searching out the virtues of medicinal plants ; and very lately by the most famous *Linnaeus* in his *Fundamenta Botanica* and *Philosophia Botanica*, from page 278. to 287. Here it is asserted, that “ Plants which agree in
 “ their genus, also agree in their virtues ; those
 “ that are contained under a natural order, likewise approach one another in virtues ; and such
 “ as agree in a natural class, also in some measure
 “ agree in their virtues.”

95. But it is very well known, that the parts of the same species very often differ widely from each other in virtues. For instance, the Root and Leaves of the common Wormwood, common Sorrel, Birthwort, &c. the Bark and Wood of the Cinnamon Tree, Citron Tree, the Tree that yields the Peruvian Bark, &c. the Leaves and Flowers of the white Lily, Jasmine, Roses, &c. the Flowers and Fruit of the Sloe Tree, Peach Tree, Pear Tree, &c. the Fruit, Bark, and Kernel of the Anacardium, Walnut, Almond, &c. What occasion is there for examples ? How much the seeds, fruits, and other parts of plants, which are in medicinal use, differ, from those parts that are not used, in virtues, no one can be ignorant, who knows how to distinguish betwixt wheat and the chaff scattered by the wind.

In like manner, the species, are different in nature, of the same genus; whether this be natural or artificial, is of little signification. The common Wormwood, and the insipid Wormwood, are quite different from one another; likewise the Succotrine Aloes, and the American Aloes; the Cinnamon, and the Sassafras; the biting Arsmart, and the mild Arsmart; the less Sedum, and the least Sedum; the male Balsam apple, and the wild Cucumber; the common Cucumber, and the Coloquintida; the acrid Ranunculus, and the sweet Ranunculus; and numberless others.

96. Much less always do those plants agree in virtues, which are contained in natural order. *Linnaeus* gives examples of such an agreement*, to wit, "The pillar-bearing (*columniferae*) plants: the Common Mallows, Marsh Mallows, Vervain Mallows, and the Cotton Bush. The pleasant delicacies (*Scitamina*): the Common Ginger, Cardamoms, Galangal, Zedoary, Costus, Grains of Paradise, and Turmeric. The orchideous: the Purple Bird's Nest (*Orchis*), Saryion, Baffard Hellebore (*Serapias*), and Epidendrum. The many-podded: the Peony, Columbines, Wolf's-Bane, Staves Acre, Nigella, Hellebore, Ranunculus, and Pasque-Flower. The contorted: the Swallow-Wort (*Apocynum*), Cynanche, Syrian Dog's-Bane (*Asclepias*), &c." But though such an agreement should really exist in these, it does not thence follow, that of consequence it is to be found in all others, or in a great number of them: especially since one plant can scarce differ more

* *Phil. Bot. p. 278.*

more in virtues from another, than the Swallow-Wort from the Syrian Dog's-Bane, the Peony from the Columbines, and both of them from the Wolf's-Bane, Nigella, Hellebore, and Ranunculus; as also these among themselves; nor truly do the Grains of Paradise come near to the Turmerick in virtues. But if we inspect those *orders*, which he has proposed * as the fragments of natural method, there are placed under the same natural order, the Wake-Robin, sweet Flag, and Red Nightshade; the true Saffron and Meadow-Saffron; the Squil and Hyacinth; the Flower-de-luce and Corn-Flag; the Lily and Tulip; the Pistachio Tree and Oak; the Elder and the Sumach; the Fig-Tree and Hemp; the Bastard Saffron and Artichoke; the Colt's-Foot and Leopard's-Bane; the Sea-Holly and Hemlock; the Olive Tree and Ash; the Bay Tree and Bistort; the Guinea Pepper and Mullein; and a great many more included under the same order, which are found to be as different in their virtues, as are aliments, medicines, and poisons; or one class of simples from another.

" Those that have an affinity (says Mr. Lin-
 " *neus*) agree in habit, manner of growing, pro-
 " perties, virtues, and use. The daily labour of
 " the greatest Botanists is employed strenuously
 " about these, and it should be strenuously em-
 " ployed about them. Hence *natural method* is,
 " and will be, the ultimate end of Botany †."
 But, whoever has seen such an affinity betwixt the
 genera of almost any one of the mentioned orders,
 sees much more clearly than me. For, if the
 Willow

* *Phil. Bot.* p. 27. ad 35.

† *Phil. Bot.* p. 137.

Willow and Plane Tree ; the Mulberry Tree and Pellitory of the wall ; the Common Heath and Strawberry Tree ; the Jew's Mallow and Lime Tree ; the Water-Elder and Holm-Oak ; the Honey Flower and Fumitory ; the Poppy and May Apple, and many others, agree in habit, I willingly acknowledge that I am ignorant of what is meant by an agreement in habit.

97. Concerning that *natural* method, " the first and last thing wanted in Botany *," it may by the by be observed, as it here occurs ; 1st, That, if we may be allowed to judge of it from the recited *fragments*, it will appear to be absolutely useless to those, that delight more in the knowledge of plants, than in a multitude of names. For, to what purpose is it to form artfully in a different manner those vicarious names (as he calls them), which are to be changed of necessity, such as *Piperitæ*, *Scitamina*, *Sepiariæ*, *Calamariæ*, *Scabridæ*, *Culmineæ*, *Vaginales*, *Sarmentaceæ*, *Candelares*, &c. ? or, even the orders themselves, whose genera are so little allied ? Since they by no means facilitate the science, which has been hitherto almost intirely lost amidst a superfluous variety of terms, methods, &c. For, the Botanical language, (as the most famous *Busson* remarks) is, in our times, much more difficultly acquired, than the knowledge of the plants themselves ; which is in a great measure owing to the school at *Upsal*, or rather to the unfortunate sexual system.

98. And,

* *Phil. Bot.* p. 27.

98. And, 2dly, If I may be permitted to speak my sentiments, those that are laboriously engaged in investigating a *natural* method of plants, seem to be laboriously engaged in finding out the philosopher's stone, since nature is only solicitous about the species: and hence it is, that all endeavours hitherto directed to this scope, have miscarried. And indeed I am afraid, lest the celebrated author of the *Philosophia Botanica*, now disdaining the sexual system, should contrive a new revolution of the Botanical Art. For, even in the *Fund. Bot.* § 209, he says, "To adhere so to the habits of plants, that the rightly drawn principles of fructification may be laid down, is to seek *folly* *instead of wisdom.*" And elsewhere (§ 168.), he advises the habit only to be consulted *occultly*. Now he seems in some measure to be of a different opinion: for, in treating of the natural method, that *ultimate end of Botany* *, he adds, "Principally three obstacles have put a bar in the way of the natural method: 1. The neglected *Habit* of plants, after the doctrine of fructification was improved, especially the new *salvation*, p. 105. &c." And in the before cited place, he talks in this strain: "The Foliation is that folded form which *the leaves keep*, while they are hid betwixt the gem and the young shoots (*asparagi*) of plants. This, which was overlooked by our predecessors, is modelled in the following ten manners, *Involuta, Revoluta, Obvoluta, Convoluta, Imbricata, Equitantia, Canduplicata, Pliscata, Reclinata, Circinalia.*" Yea, in the *Fund. Bot.*

* *Phil. Bot.* p. 137.

Bot. § 163. he has fully commented on the Habit from p. 101. to 112. of his *Philosophia Botanica*, where indeed many things very lately discovered are to be met with; yet scarce any of them are very useful.

99. "The taste, smell, and colour, point out those qualities of plants, in which their virtues consist," Fund. Bot. § 358. Concerning the use of the senses, especially *Tasting*, in discovering the virtues of plants, many things occur in various authors. But no one seems to have carefully enough observed the differences of *tastes*; and likewise some compound are esteemed simple tastes, and others that only differ in degree are reckoned distinct species of them. Wherefore, our *Grew*, not being content with the doctrine delivered in the schools, after re-examining and nicely weighing the whole matter, has observed and distinguished sixteen different *species of simple tastes*; from the conjunctions of these, almost innumerable *compound*; and their very various differences, with respect to their *degrees*, *duration*, and the *subject* which they affect. [See *Grew's treatise on the differences and causes of tastes*, published in his *Anatomy of Plants*, or *Ray's Hist. Pl.* from p. 46. to 50.] Whoever will examine the tastes of plants, in *Grew's* manner which has been hitherto neglected, will in a great measure find out the virtues of very many, but by no means of all plants.

The consideration of smells is also in some degree useful, though more rarely. "The *Ambrosiac* (*Sweet*), are Analeptics, the Fragrant, "Orgastics

“*Orgastics* (*Cordials*), the *Aromatics* *stimulants*,
 “the disagreeably smelling (*tetra*) *stupefying*, the
 “*Nauseous* *corrosives*,” *Fund. Bot.* § 362. And
 according to the *Philosophia Botanica*, p. 284,
 The *Ambrosiac* are the *Squinancy* wort (*Asperula*),
Abelmosch, *Musked Crane’s-bill*, *Musk Mallows*,
Millet, and *Aira*; and act like *Ambergrease*, *Musk*,
 and *Civet*. The *Fragrant*, flowers of *Saffron*, the
Jasmine, *Violet*, &c. and commend themselves by
 their most agreeable smell. The *Aromatics*, the
Bay Tree, *Sassafras*, *Camphor*, &c. commonly a-
 gree in smell and taste. The *Heavily Smelling*
 (*Graveolentia*), which are singular, are, the *Alli-*
aceous, *Garlick*, *Water-Germander*, *Asa foetida*,
 &c. The *Stinking* (*Hircina*), the *Purple Bird’s-*
Nest (*Orchis*), *stinking Hawkweed*, *stinking*
Orache, and *Herb Robert*. The *Tetra* are known
 very well by their disagreeable smell; the *stink-*
ing Mayweed, *Opium*, *Elder*, &c. The *Nau-*
seous, or such as when taken into the stomach are
 thrown up by nature; the white *Hellebore*, *Bear’s*
Foot, *Lily of the Valley* (*Convallaria*), *Asara-*
bacca, *Tobacco*, and *Coloquintida*. Thus this
 aphorism is explained by the most famous author.
 But how these *nauseous* things, are to be called
corrosives; or the *Tetra*, *stupefacient*; or in what
 these *Ambrosiac*, *Fragrant*, and *Aromatic* sub-
 stances agree among themselves, I by no means
 see. For, if I be not mistaken, the flowers of the
Mezereon, *Daffodill*, *Hyacinth*, &c. may with
 equal reason be called *Ambrosiac*, (for this is an
 uncommon term), or at least *Fragrant*, as those
 above mentioned, how much soever they differ in
 virtues.

In

In a word, whoever takes the virtues of plants, from the taste and smell, and much more from their colour and native place, will be very often led into error. But such plants as agree exactly, in fructification, as well as in taste and smell, are very seldom observed hitherto to differ in virtues.

100. Concerning the *Culture* of vegetables I have nothing to add. My most worthy friend, *Philip Miller*, Fellow of the Royal Society, has gained this province, and adorns it, in his learned *Gardener's Dictionary*, which is in every one's hands. "*Miller's Gardener's Dictionary*, says "*Linnaeus*, (in *Phil. Bot.* p. 263.) delivers the "*particular culture of each plant*; but this "*Method of horticulture would be too diffused and "*troublesome through all the discovered species "*of plants. The foundation of Horticulture de- "*pends upon the native place of plants, whence "*the rules and principles of the art are to be "*formed.*" Yet, it is manifest from experience, that a great many plants can bear our winters, and thrive much in gardens, whose native place differs greatly from ours, both in weather and soil: and howsoever *diffused and troublesome the method of the Dictionary is*, the culture of more plants is there described, than I think are nursed in any garden in *Europe*; and at the same time, in short, it is to be found more easily and sooner, than it can be investigated in any other author, or with the assistance of the rules laid down in the *Philosophia Botanica*, from p. 263. to 270. And hence it is, that the dictionary has been printed within*****

about twenty years six times ; and its abridgment four times.

§ XXV.

Since all those that rightly treat of the method of studying medicine, extol Botany in the highest manner, and its discipline or instruction is not less friendly to the body, than necessary to the mind, it is needless to enlarge here on the celebration of its praises. I have however judged it proper, to give a general view of plants according to *Tournefort's* method, to assist the memory : And lest the Index should be drawn out to too great length; from the order of the plants being needlessly interrupted, I shall subjoin the titles of the classes and sections, a little abbreviated; also the names of the genera described by him, with some others more recently discovered ; and add the generical names of *Linnaeus* which differ from those of *Tournefort*.

Herbs and under shrubs are, either Anthophorous, such as bear flowers, or Ananthous, such as bear no flowers. The anthophorous are either Peralodes, furnished with flower-leaves, or Apetalous, want flower-leaves. The petalodes have either a Simple or a Compound flower. Those that carry a simple flower are either Monopetalous, such as have only one flower-leaf, (though, without an accurate examination of it at the bottom, it is sometimes much divided into laciniae or jags, and so apparently consists of several petals), or Polypetalous, such as carry many flower-leaves.

The

The monopetalous are, the Campaniform, bell-shaped, *Class 1.* Infundibuliform, funnel like, or Rotated, wheel-shaped, *Class 2.* Labiated, such as resemble lips, *Class 3.* and Anomalous, such as are irregularly shaped, and cannot for this reason be easily reduced under a particular name to any of the former classes, *Class 4.* The polypetalous are, the Cruciform, cross-like, *Class 5.* Rosaceous, rose-like, *Class 6.* Umbellated, umbelliferous, or resemble an umbella or umbrella, *Class 7.* Caryophyllaceous, july-flower-like, *Class 8.* Liliaceous, lily-like, *Class 9.* Papilionaceous, such as have some faint similitude to a butter fly, *Class 10.* and Anomalous, such as cannot well be distinguished by names and brought under the foregoing classes on account of their singular figures, *Class 11.* Those that bear a compound flower are, the Floscular, such as have many small tubular petals, *Class 12.* Semifloscular, such as have many small petals, but longer than the former, broader, flatter, and not apparently fistular, *Class 13.* and Radiated, *Class 14.* which are composed of an internal or central floscular and an external or circumferential semifloscular part, the latter being disposed like rays of light and horizontally; the interior part is called discus, from its resemblance of an horse-shoe, and the exterior corona, from its distant likeness to a crown. The Apetalous, constitute *Class 15.* The ananthous are, either Spermatophorous, such as produce seed, or Aspermous, such as are commonly reckoned to produce no seed. The Spermatophorous, make up *Class 16.* and the Aspermous, form *Class 17.* Trees and Shrubs are, either Apetalous, or Petalodes. The apetalous are,

are, the Stamineous, such as bear flowers, consisting of threads, *Class* 18. and Amentaceous, juliferous, such as bear amenta, juli, or catkins, *Class* 19. The petalodes are, the Monopetalous, *Class* 20. Rosaceous, *Class* 21. and Papilionaceous, *Class* 22.

CLASS I.

Herbs monopetalous
campaniform.

1. With a pistillum which
changes into a soft fruit.

Mandragora.

Belladonna. *Atropa.*

Lilium convallium. *Convallaria.*

Polygonatum. *Convallaria.*

Ruscus.

2. With a pistillum which
changes into a dry fruit.

Cerinthe.

Gentiana.

Hydrophyllon.

Soldanella.

Convolvulus.

Cuscuta.

Tithymalus. *Euphorbia.*

Tithymaloïdes. *Euphorbia.*

Euphorbium. *Euphorbia.*

Manihot. *Jatropha.*

Glaux.

Oxys. *Oxalis.*

3. With a pistillum which
changes into a single seed.

Rhabarbarum.

4. With a pistillum which
changes into a fruit, composed of small sheaths or follicles.

Cotyledon.

Apocynum.

Periploca.

Asclepias.

5. With a pistillum, which
is surrounded with the
stamina united at their
base into a tube, and
changes into a multi-
capsular fruit.

Malva.

Althæa.

Alcea.

Malacoides. *Malope.*

Lavatera.

Abutilon.

Aburilon. *Sida*.
Ketmia. *Hibiscus*.
Xylon. *Gossypium*.

6. With a calyx which changes into a fruit, for most part fleshy.

Bryonia.
Tamnus. *Tamus*.
Sicyoides. *Sicyos*.
Momordica.
Luffa. *Momordica*.
Cucumis.
Melo. *Cucumis*.
Pepo. *Cucurbita*.
Melopepo. *Cucurbita*.
Cucurbita.
Anguria. *Cucurbita*.
Colocynthis. *Cucumis*.

7. With a calyx which changes into a dry fruit.

Campanula.
Rapunculus. *Phyteuma*.
Valantia.

8. With a calyx which changes into a twin fruit.

Rubia.
Aparine.
Gallium. *Galium*.
Cruciata. *Galium*.

CLASS II.

Herbs monopetalous infundibuliform, and rotated.

1. With a pistillum which changes into the fruit.

Quamoclit. *Ipomœla*.
Menyanthes.
Nicotiana.
Hyoscyamus.
Stramonium. *Datura*.
Pervinca. *Vinca*.
Auricula Urſi. *Primula*.
Plantago.
Coronopus. *Plantago*.
Pſyllium. *Plantago*.

2. With a calyx which changes into the fruit.

Jalapa. *Mirabilis*.
Rubeola. *Asperula*.
Trachelium.
Valeriana.
Valerianella. *Valeriana*.
Ananas. *Bromelia*.

3. With a pistillum which changes into a fruit, consisting of four naked seeds.

Borrago.
Buglossum.

Buglossum. *Anchusa.*
 Asperugo.
 Echium.
 Echioides. *Lycopsis.*
 Pulmonaria.
 Lithospermum.
 Symphytum.
 Heliotropium.
 Cynoglossum.
 Omphalodes. *Cynoglossum.*

4. With a pistillum which changes into a single seed.

Plumbago.

5. Rotated, with a pistillum which changes into a dry fruit.

Lyfimachia.
 Hortonia.
 Anagallis.
 Samolus.
 Veronica.
 Chrysosplenium.
 Polemonium.
 Verbascum.
 Blattaria. *Verbascum.*
 Polygonoides. *Calligonum.*

6. Rotated, with a pistillum which changes into a soft fruit.

Solanum.
 Lycopersicon. *Solanum.*
 Alkekengi. *Physalis.*
 Melongena. *Solanum.*
 Capsicum.
 Nymphoides. *Menyanthes.*
 Cyclamen.
 Moschatellina. *Adoxa.*

7. Rotated, with a calyx which changes into the fruit.

Pimpinella.

C L A S S III.

Herbs monopetalous labiated.

1. With the upper lip bent like a helmet or faucion.

Phlomis.
 Horminum. *Salvia.*
 Scalaria. *Salvia.*
 Salvia.
 Dracocephalon. *Dracocephalum.*
 Cassida. *Scutellaria.*
 Brunella.

2. With the upper lip bowed like a spoon.

Lamium.
 Moldavica.

Moldavica. *Dracoc-*
phalum.
 Ballote. *Ballota.*
 Galeopsis.
 Stachys.
 Cardiaca. *Leonurus.*
 Leonurus.
 Molucca. *Molucella.*
 Pseudodictamnus. *Mar-*
rubium.
 Mentha.
 Marrubiastrum. *Cunila.*
 Lycopus.

3. With the upper lip erect.

Sideritis.
 Marrubium.
 Melissa.
 Calamintha. *Melissa.*
 Clinopodium.
 Rosmarinus.
 Thymus.
 Serpyllum. *Thymus.*
 Satureia.
 Thymbra. *Satureia.*
 Lavendula.
 Origanum.
 Majorana. *Origanum.*
 Verbena.
 Hyssopus.
 Stoechas. *Lavendula.*
 Cataria. *Nepeta.*
 Betonica.
 Ocimum.

4. Such as have but one lip.

Chamædrys. *Teucrium.*
 Polium. *Teucrium.*
 Teucrium.
 Chamæpitys. *Teucrium.*
 Bugula. *Teucrium.*

CLASS IV.

Herbs monopetalous ano-
 malous.

1. With a flower that hath
 a long ear, or hood.

Arum.
 Dracunculus. *Dracon-*
tium.
 Arisarum. *Arum.*

2. With a tubular flower,
 ending in a tongue.

Aristolochia.
 Rapuntium. *Labellia.*

3. With a flower, open at
 both ends.

Bignonia.
 Digitalis.
 Scrophularia.
 Pinguicula.

4. With

4. With a tubular flower,
and personated or re-
sembling a vizard or
mask.

Antirrhinum.

Linaria. *Antirrhinum*.

Phelypæa.

Morina.

Afarina. *Antirrhinum*.

Ageratum. *Erinus*.

Pedicularis.

Melampyrum.

Chelone.

Euphrasia.

Polygala.

Chamæbuxus. *Polygala*.

Adhatoda. *Justicia*.

Coris.

Clandestina. *Lathræa*.

Orobanche.

Dodartia.

Anblatum. *Squamaria*.

Elephas. *Rhinanthus*.

5. With the flower end-
ing in a ring.

Acanthus.

CLASS V.

Herbs tetrapetalous cru-
ciform.

1. With an unicapsular
fruit, but not busked, or
podded.

Jonthlaspi. *Clypeola*.

Rapistrum. *Myagrum*.

Myagrum.

Ifatis.

Crambe.

Cakile. *Raphanus*.

Vesicaria. *Alyssum*.

2. With a pretty short
fruit, divided into two
parts, by an intermediate
partition, with respect of
the valves, placed ob-
liquely to the perpendi-
cular.

Thlaspi.

Nasturtium. *Lepidium*.

Thlaspidium. *Biscutella*.

Cochlearia.

Lepidium.

Bursa pastoris. *Thlaspi*.

3. With the fruit, divided
into two parts, by an
intermediate partition,
parallel to the valves.

Alysson. *Alyssum*.

Alyfiorides. *Alyssum*.

Lunaria.

4. With a bicapsular fruit,
and busked, or podded.

Brasica.

Leucoium. *Cheiranthus*.

Hespe-

CLASS VI.

Herbs rosaceous.

1. With a pistillum which changes into an unicap-sular fruit, opening two ways transversely.

Amaranthus.

Portulaca.

2. With a pistillum which changes into an unicap-sular fruit.

Papaver.

Argemone.

Anapodophyllon. Podor-
phyllum.

Opuntia. Cactus.

Melocactus. Cactus.

Cereus. Cactus.

Ficoides. Mesembryan-
themum.

Granadilla. Passiflora.

Murucua. Passiflora.

Mitella.

Leontopetalon. Leontice.

Alfene.

Alfinastrum. Elatine.

Myosotis. Cerastium.

Ros Solis. Drosera.

Parnassia.

Juncus.

Kali. Salsola.

Telephium.

R 2

Tri-

Hesperis.

Turritis.

Cardamine.

Dentaria.

Sisymbrium.

Eruca. Brassica.

Sinapi.

Erysimum.

Rapa. Brassica.

Napus. Brassica.

Raphanus.

5. With a jointed husk.

Raphanistrum. Rapha-
nus.

Hypecoon. Hypecoun.

6. With an unicap-sular
husk.

Chelidonium.

Sinapistrum. Cleome.

Epimedium.

7. With the fruit divided
into three or four cells.

Erucago. Bunias.

8 With the fruit consist-
ing of seeds collected in-
to a small head.

Potamogeton.

9. With a soft fruit.

Herba Paris. Paris.

Tribuloides. *Trapa*. Nymphaea.

Helianthemum. *Cistus*.

Androsæmum. *Hypericum*.

3. With a pistillum which changes into the fruit for most part bicapsular.

Geum. *Saxifraga*.

Saxifraga.

Salicaria. *Lythrum*.

Glaucium. *Chelidonium*.

4. With a pistillum which changes into a multicapsular fruit.

Chamelæa. *Cneorum*.

Hypericum.

Ascyrum. *Hypericum*.

Sarracena.

Pyrola.

Damasonium. *Alisma*.

Orobanchoides. *Mono-*

tropa.

Ruta.

Harmala. *Peganum*.

Nigella.

Garidella.

Fabago. *Zygophyllum*.

Corchorus.

Hermania.

Telephioides. *Andragb-*

ne.

Cistus.

5. With a pistillum which changes into a fruit, in which the seeds are lodged as it were in nests.

Nelumbo. *Nymphaea*.

Capparis.

6. With a pistillum which changes into a fruit, composed of many capsulae.

Sedum.

Anacampseros. *Sedum*.

Ulmaria. *Filipendula*.

Barba capræ. *Aruncus*.

Fagonia.

Tribulus.

Juncago. *Triglochin*.

Geranium.

Thalictrum.

Butomus.

Helleborus.

Veratrum.

Populago. *Caltha*.

Pæonia.

7. With a pistillum which changes into a fruit, composed of many seeds collected into a small head.

Ane-

Anemone. *Pulsatilla*.
Pulsatilla.
Ranunculus.
Filipendula.
Clematitis. *Clematis*.
Caryophyllata. *Geum*.
Fragaria.
Quinquefolium. *Potentilla*.
Tormentilla.
Pentaphylloides. *Potentilla*.

8. With a soft fruit.

Christophoriana. *Actæa*.
Phytolacca.
Solanoides. *Rivinia*.
Aralia.
Asparagus.
Smilax.
Menispermum.

9. With a calyx which changes into a dry fruit.

Cuminoides. *Lagoecia*.
Circæa.
Agrimonia.
Agrimonoides. *Agrimonia*.
Onagra. *Oenothera*.
Chamaenerion. *Epilobium*.

10. With a fruit separated from the flower.

Ricinoides. *Croton*.
Begonia.
Morus Rana. *Hydrocharis*.

CLASS VII.

Herbs umbellated.

1. With small and striated seeds.

Ammi.
Apium.
Cicuta. *Conium*.
Carvi. *Carum*.
Phellandrium.
Bulbocastanum. *Bunium*.
Daucus.
Sium.
Sisarum. *Sium*.
Tragofelinum. *Pimpinella*.
Bupleurum.

2. With narrow, oblong, and pretty thick seeds.

Fœniculum. *Anethum*.
Meum. *Athamanta*.
Oenanthe.
Angelica. *Ægopodium*.
Astrantia.
Charophyllum.
Myrrhis. *Cherophyllum*.

3. With

3. *With roundish and
thickish seeds.*

Smyrniūm.

Coriandrum.

4. *With plane, oval, and
pretty large seeds.*

Imperatoria, et Angelica.

Crithmum.

Anethum.

Peucedanum.

5. *With oval, plane, large
seeds.*

Oreoselinum. *Selinum.*

Thyffelinum. *Selinum.*

Pastinaca.

Sphondylium. *Hera-
cleum.*

Tordylium.

Ferula.

Thapsia.

6. *With large seeds, whose
sides are deeply bol-
lowed.*

Cicutaria. *Ligusticum.*

Caucalis.

Echinophora. *Caucalis.*

Ligusticum.

Laserpitium.

7. *With seeds covered
with a spongy bark.*

Cachrys.

8. *With seeds ending in
a long tail.*

Scandix.

9. *With umbells rolled up
into a small head.*

Sanicula.

Eryngium.

Hydrocotyle.

CLASS VIII.

Herbs caryophyllæous.

1. *With a pistillum which
changes into the fruit.*

Caryophyllus.

Lychnis.

Cucubalus.

Linum.

2. *With a pistillum which
changes into the seed,
wrapt up in the calyx.*

Statice.

Limonium.

CLASS IX.

Herbs liliaceous.

1. *Monopetalous, with a
pistillum*

pistillum which changes
into the fruit.

Asphodelus.
Lilio-Asphodelus. *Hemero-*
merocallis.

Hyacinthus.

Muscari. *Hyacinthus.*

Colchicum.

Bulbocodium. *Crocus.*

2. *Monopetalous*, with a
calyx which changes in-
to the fruit.

Crocus.

Narcissus.

Iris.

Xiphion. *Iris.*

Hermodactylus. *Iris.*

Sisyrinchium. *Iris.*

Gladiolus.

Aloe.

Yucca.

Cannacorus. *Canna.*

Zingiber. *Amomum.*

Hæmanthus.

3. *Tripetalous.*

Ephemerum. *Tradef-*
cantia.

Aloides. *Stratiotes.*

4. *Hexapetalous*, with a
pistillum which changes
into the fruit.

Phalangium. *Antheri-*
cum.

Liliastrum. *Hemero-*
callis.

Lilium.

Lilio-Hyacinthus.

Scilla.

Corona Imperialis. *Pe-*
tilium.

Tulipa.

Fritillaria.

Dens Canis. *Erythro-*
nium.

Methonica. *Gloriosa.*

Ornithogalum.

Aphyllanthes.

Porrum.

Cepa.

Allium.

5. *Hexapetalous*, with a
calyx which changes in-
to the fruit.

Lilio-Narcissus. *Ama-*
ryllis.

Narcisso-Leucoium.

Leucoium.

Bermudiana. *Sisyrin-*
chium.

CLASS X.

Herbs papilionaceous,
or leguminous.

1. With a short *tricap-*
sular pod, or *busk.*

Gly-

Glycyrrhiza.

Cicer.

Lens. Cicer.

Onobrychis. *Hedysarum*.

Vulneraria. *Anthyllis*.

Dorycnium.

2. *With a long unicap-
sular pod.*

Faba.

Lupinus.

Orobus.

Pisum.

Lathyrus.

Clymenum. *Lathyrus*.

Nissolia.

Ochrus. *Pisum*.

Vicia.

Ervum.

Galega.

Astragaloides. *Phaca*.

Aphaca. *Lathyrus*.

Ternatea. *Clitoria*.

3. *With a jointed pod.*

Securidaca. *Coronilla*.

Ornithopodium. *Orni-
thopus*.

Ferrum equinum. *Hip-
pocrepis*.

Hedysarum.

Scorpioides. *Scorpiu-
rus*.

4. *Three-leaved.*

Lotus.

Trifolium.

Melilotus. *Trifolium*.

Anonis. *Ononis*.

Fœnum Græcum. *Tri-
gonella*.

Medica. *Medicago*.

Medicago.

Phaseolus.

5. *With a bicapsular pod.*

Astragalus.

Tragacantha.

Pelecinus. *Biserrula*.

CLASS XI.

Polypetalous anoma-
lous.

1. *With a pistillum which
changes into an unicap-
sular fruit.*

Balsamina. *Impatiens*.

Viola.

Fumaria.

Capnoides. *Fumaria*.

Reseda.

Luteola. *Reseda*.

2. *With a pistillum which
changes*

on BOTANY.

changes into an unicap-
sular fruit.

Sesamoides. *Reseda*.
Aconitum.
Delphinium.
Aquilegia.
Fraxinella. *Distamnus*.
Cardaminum. *Tropæ-
olum*.
Melianthus.
Corindum. *Cardiosper-
mum*.

3. With a calyx which
changes into the fruit.

Orchis.
Helleborine. *Serapias*.
Calceolus. *Cypripedium*.
Limodorum. *Orchis*.
Ophris. *Ophrys*.
Nidus avis. *Neottia*.

CLASS XII.

Herbs Floscular.

1. With a flower sepa-
rated from the fruit.

Xanthium.
Ambrosia.
Gnaphalodes. *Micropus*.

2. With downy seed.

Carduus.
Cinara. *Cynara*.
Jacea. *Centaurea*.
Cyanus. *Centaurea*.
Cirsium. *Carduus*.
Centaurium majus. *Cen-
taurea*.
Lappa. *Arctium*.
Cnicus.
Petasites. *Tussilago*.
Cacalia. *Tussilago*.
Elichrysum. *Gnapha-
lium*.
Filago. *Gnaphalium*.
Conyza.
Eupatorium.
Senecio.

3. With seed not downy:

Carthamus.
Absinthium. *Artemisia*.
Abrotanum. *Artemisia*.
Artemisia.
Santolina.
Gnaphalium.
Tanacetum.
Conyzoides. *Erigeron*.
Bidens.

4. With floscules placed
in their own calyx, and
divided into equal jag.

Echinopus.

S

Ama-

Amaranthoides. *Gomphrena*.

5. *With floscules placed in their own calyx, and for most part divided into unequal jags.*

Scabiosa.
Lychniscabiosa. *Knautia*.
Dipsacus.
Gundelia.
Globularia.

CLASS XIII.

Herbs semi-floscular.

1. *With downy seed.*
Dens Leonis. *Leontodon*, &c.
Hieracium, &c.
Lactuca.
Sonchus, &c.
Chondrilla.
Zacintha. *Lapsana*.
Scorzonera.
Tragopogon.

2. *With seed not downy.*
Catanance. *Catananche*.
Hedypnois. *Lapsana*.
Cichorium.

Lampsana. *Lapsana*.
Rhagadiolus. *Lapsana*.
Scolymus.

CLASS XIV.

Herbs radiated.

1. *With downy seeds*
Aster. *Inula*, &c.
Virga aurea. *Solidago*.
Jacobaea. *Senecio*.
Tussilago.
Doronicum.

2. *With seeds furnished with a small leaved head.*

Tagetes.
Anemonospermus. *Arctotis*.
Corona Solis. *Helianthus*.

3. *With seed without down and a small leaved head.*

Bellis.
Chrysanthemum.
Leucanthemum. *Chrysanthemum*.
Matricaria.
Chamæmelum. *Anthemis*.
Cotula.

Buph.

Bupthalmum.
 Millefolium. *Achillea*.
 Ptarmica. *Achillea*.
 Asteriscus. *Buphtal-*
mum.
 Asteroides. *Buphtal-*
mum.
 Chrysanthemoides. *Of-*
teospermum.
 4. With seeds lodged in
 a capsula.
 Caltha. *Calendula*.
 5. With a crown compo-
 sed of plane petala.
 Xeranthemum.
 Carlina.

CLASS XV.

Herbs apetalous.

1. With a posterior part of
 the calyx which changes
 into the fruit.
 Asarum.
 Hypocistis. *Asarum*.
 Beta.
 2. With a pistillum which
 changes into the seed,
 hood-wink'd in the ca-
 lyx.

Acetosa. *Rumex*.
 Eupathum. *Rumex*.
 Atriplex.
 Chenopodium.
 Blitum. *Amaranthus*.
 Herniaria.
 Paronychia. *Herniaria*.
 Alchimilla. *Alchemilla*.
 Parietaria.
 Camphorata. *Polycne-*
mum.
 Persicaria.
 Polygonum.
 Fagopyrum. *Helxine*.
 Bistorta.
 Salicornia.

3. Cereal, or Culmiferous,
 or such as have stems
 with ears.

Triticum.
 Secale.
 Hordeum.
 Oryza.
 Avena.
 Milium. *Panicum*.
 Panicum.
 Gramen. *Triticum*, &c.
 Arundo.

4. With flowers collected
 into a small, scaly bead,
 Cyperus.

Scirpus.
Linagrostis. *Eriophorum*.

5. With a flower, in the same plant, separated from the fruit.

Cyperoides. *Carex*.
Typha.
Acorus.
Sparganium.
Mays. *Zea*.
Lachryma Job. *Cair*.
Ricinus.
Cynocrambe. *Theligonum*.
Lenticula. *Lemna*.

6. With the flower in one, and the fruit for most part in another plant.

Equisetum.
Spinacia.
Mercurialis.
Ceratoides. *Urtica*.
Urtica.
Cannabis.
Cannabina. *Cannabis*.
Lupulus. *Hamulus*.

CLASS XVI.

Herbs ananthous, spermatophorous.

1. With a fruit which grows upon the leaves.

Filix. *Pteris*, &c.
Lonchitis. *Polypodium*.
Trichomanes. *Asplenium*.

Polypodium.
Ruta muraria. *Asplenium*.

Filicula. *Polypodium*.
Adiantum.
Asplenium.
Lingua Cervina. *Asplenium*.

Hemionitis. *Asplenium*.

2. With a fruit which does not grow upon the leaves.

Osmunda.
Ophioglossum.
Lichen.

CLASS XVII.

Herbs which are commonly thought to have neither flowers nor fruit.

1. Such as grow on the land.

Muscus.
Fungus.

Fungus.
Fungoides.
Boletus. *Phallus*.
Agaricus.
Lycoperdon.
Coralloides. *Clavaria*.
Tubera. *Lycoperdon*.

2. Such as grow in the
sea, or in rivers.

Fucus.
Alga.
Acetabulum. *Sertularia*.
Corallina. *Sertularia*.
Corallum.
Madrepora.
Lithophyton. *Litboxylum*.
Tubularia. *Tubipora*.
Spongia.
Eschara. *Millepora*.
Alcyonium.

CLASS XVIII.

Trees apetalous.

1. With a flower con-
joined with the fruit.

Fraxinus.
Siliqua. *Ceratonia*.
Ficus.

2. With a flower, in the
same plant, separated
from the fruit.

Buxus.
Empetrum.

3. With the flower in one,
and the fruit for most
part in another plant.

Terebinthus. *Pistacia*.
Lentiscus. *Pistacia*.
Rhamnoides. *Hippophae*.
Ephedra.
Cassia. *Osyris*.
Gale. *Myrica*.

CLASS XIX.

Trees amentaceous.

1. With a flower, in the
same plant, separated
from a stony fruit.

Nux. *Juglans*.
Corylus.
Carpinus.

2. With a flower, in the
same plant, for most
part separated from the
fruit, whose covering is
coriaceous.

Quercus.
Ilex. *Quercus*.
Suber.

Saber. *Quercus.*

Fagus.

Castanea. *Fragus.*

3. With a flower, in the same plant, separated from a scaly fruit.

Abies.

Pinus.

Larix. *Abies.*

Thuya.

Cupressus.

Alnus.

Betula.

4. With a flower separated from a soft fruit.

Cedrus. *Juniperus.*

Juniperus.

Sabina. *Juniperus.*

Taxus.

Morus.

5. With a flower, in the same plant, separated from a dry fruit.

Platanus.

6. With the flower in one plant, and the fruit in another.

Salix.

Populus.

CLASS XX.

Trees monopetalous.

1. With a pistillum which changes into a soft fruit full of callous seeds.

Rhamnus.

Thymelaea. *Daphne.*Alaternus. *Rhamnus.*

Phillyrea.

Cassine.

Ligustrum.

Laurus.

Jasminum.

Coffea.

Acajou. *Anacardium.*

Genipa.

Arbutus.

2. With a pistillum which changes into a fruit full of stony seeds.

Styrax.

Olea.

Ahouai. *Ebevetia.*Uva Ursi. *Arbutus.*Aquifolium. *Hex.*Guajacana. *Diospyrus.*

3. With a pistillum which changes into a membranaceous fruit.

Ulmus.

4. With

4. With a pistillum which changes into a multicap-sular fruit.

Lilac. *Syringa*.
Alaternoides. *Celastrus*.
Erica.
Vitex.
Chamærhododendros.
Azalea.

5. With a pistillum which changes into a bursky fruit.

Nerion. *Nerium*.
Plumeria.
Acacia. *Mimosa*, &c.
Mimosa.

6. With a calyx which changes into a fruit, or berry.

Sambucus.
Opulus. *Viburnum*.
Viburnum.
Tinus. *Viburnum*.
Vitis Idæa. *Vaccinium*.
Oxycoccus. *Vaccinium*.
Caprifolium. *Lonicera*.
Periclymenum. *Lonicera*.
Chamacerasus. *Lonicera*.
Xylosteon. *Lonicera*.

Diervilla.

Elæagnus.

7. With the flower in one, and the fruit in another plant.

Viscum.

CLASS XXI.

Trees rosaceous.

1. With a pistillum which changes into an unicap-sular fruit.

Cotinus.
Toxicodendron. *Rhus*.
Rhus.
Molle. *Schinus*.
Tilia.
Tamariscus. *Tamarix*.
Hippocastanum. *Esculus*.

2. With a pistillum which changes into a single, or manifold berry.

Celtis.
Frangula. *Rhamnus*.
Hedera.
Vitis.
Berberis.
Rubus.

3. With

3. With a pistillum which changes into a multicapsular fruit.

Acer.

Liquidambar.

Pavia.

Staphylodendron. *Staphylea*.

Paliurus. *Rhamnus*.

Thea.

Azedarach. *Melia*.

Euonymus.

Syringa. *Philadelphus*.

4. With a pistillum which changes into a fruit, composed of little husks or seeds, collected into a small bead.

Spiraea.

Tulipifera. *Liriodendrum*.

Magnolia.

5. With a pistillum which changes into a husky or podded fruit.

Senna. *Cassia*.

Poinciana.

Cassia.

Tamarindus.

6. With a pistillum which

changes into a fleshy fruit, full of callous seeds.

Aurantium. *Citrus*.

Citretum. *Citrus*.

Limon. *Citrus*.

Papaya. *Carica*.

Cacao. *Theobroma*.

7. With a pistillum which changes into a fruit filled with a small stone.

Prunus.

Armeniaca. *Prunus*.

Perfica. *Amygdalus*.

Cerasus. *Amygdalus*.

Amygdalus.

Sapindus.

Ziziphus. *Rhamnus*.

Oenoplia.

Myxa. *Cordia*.

Laurocerasus. *Padus*.

Palma. *Phœnix*.

8. With a calyx which changes into a fruit, filled with a single seed.

Caryophyllus aromaticus.

9. With a calyx which changes into a fruit, full of callous seeds.

Pyrus.

Pyrus.
Cydonia. *Pyrus.*
Cratægus.
Sorbus.
Malus. *Pyrus.*
Punica.
Guajava. *Psidium.*
Rosa.
Grossularia. *Ribes.*
Myrtus.
10. With a calyx which
changes into a fruit, full
of small stones.
Cornus.
Mespilus.

Genista-Spartium. *Ge-
nista.*
Alhagi. *Hedysarum.*
Erinacea.
Genistella. *Genista.*
Siliquastrum. *Cercis.*
2. With three leaves
which grow on a single
foot-stalk.
Anagyris.
Corallodendron. *Ery-
thrina.*
Cytisus.
Cytiso-Genista. *Sparti-
um.*

CLASS XXII.

Trees papilionaceous.

1. With single leaves,
placed in an alternate
or verticillate order.

Genista.
Crotalaria.
Spartium.

3. With Leaves in cou-
ples which grow for
most part to the side.

Pseudoacacia. *Robinia.*
Colutea.
Emerus. *Coronilla.*
Coronilla.
Barba Jovis. *Anthyllis.*

To this methodical distribution of vegetables
by *Tournefort*, in the *Tirocinium Botanicum*, the
Doctor has annexed the *Fundamenta Botanica* of
Linnaeus; from the author's last edition in the *Phi-
losophia Botanica*, and an *Index of Plants*: But,
as he observes that he only added the former, to
assist the Students of this Art to be able to form a

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better

Better judgment, with what right a Novice may venture to dissent from the most illustrious Botanists of the present Age; and, as the latter, contains a list of plants, chiefly the medicinal, nursed in two Gardens at *Edinburgh*, which he sometimes demonstrates in the garden properly belonging to the City, and sometimes in the royal garden adjoining to the King's palace, called *Holy-rood-house*, and is principally serviceable to those that attend his Praelections and Demonstrations; they are both here omitted.

CLASS XXII.

THE END.

To this methodical distribution of vegetables by Linnaeus, in the *Travels* of the *Traveller* in the *Travels* of the *Traveller*, the Doctor has annexed the *Travels* of the *Traveller* in the *Travels* of the *Traveller*, from the author's last edition in the *Travels* of the *Traveller*, and an *Index* of *Plants*. But, as he observes that he only added the former, to assist the Students of this Art to be able to form a better

